Number 33 Series 1925

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
In cooperation with the Oregon Agricultural Experiment Station

SOIL SURVEY
OF
THE EUGENE AREA, OREGON

BY
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Oregon Agricultural Experiment Station

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AREA SURVEYED

The Eugene area is in Lane County, Oreg. The county lies in the west-central part of the State and extends from the summit of the Cascade Range on the east to the Pacific Ocean on the west. About one-half the land in the county is in national forests and the remainder is under private ownership. About 30,000 acres is located in remote mountainous districts of unappropriated Government land. The area covered by this survey is located in the central part of the county and includes only land under private ownership. For economic reasons the survey has been limited to the better-developed agricultural lands bordering Willamette River and its tributaries, together with some bordering mountainous areas, some of which, on the west, are drained by the headwaters of Siuslaw River, which flows west to the Pacific Ocean. Portland, the principal city of the State and an important shipping point and market for surplus agricultural and lumber products, is about 100 miles north of the northern boundary of the area, and Ashland, near the southern boundary of the State, is about 100 miles south of the southern boundary.

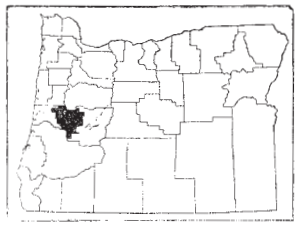

FIGURE 1.—Sketch map showing location of the Eugene area, Oregon

The boundaries of the area surveyed have been drawn to include the major agricultural areas of the county. Several well-developed farming areas bordering the Pacific Ocean were omitted because to include them it would have been necessary to include also a large intervening inaccessible mountainous area, which did not warrant the time and expense necessary for detailed mapping. On the north and to the west of Willamette River for a distance of 11 miles this area joins with a previous soil survey covering Benton County.[1] Willamette River forms the boundary between this area and a previous survey covering Linn County,[2] for a distance of about 7 miles. From this point the boundary of the area is irregular, as may be seen by a study of the detailed soil map accompanying this report. The area is approximately 50 miles long and 50 miles wide along its greatest dimensions. It contains 1,298 square miles, or 830,720 acres.

The elevation at Eugene is 449 feet above sea level, at Cottage Grove 640 feet, at Junction City 320 feet, and at Elmira 387 feet. Elevations of more than 4,000 feet occur within the mountainous parts of the area surveyed.

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[1] CARPENTER, E. J., and TORGERSON, E. F. SOIL SURVEY OF BENTON COUNTY, OREG. U. S. Dept. Agr., Bur. Soils, Field Oper. 1920, Rpt. 40: pp. 1431–1474, illus. 1920.

[2] KOCHER, A. E., CARPENTER, E. J., HARPER, W. G., TORGERSON, E. F., and STEPHENSON, R. E. SOIL SURVEY OF LINN COUNTY, OREG. U. S. Dept. Agr., Bur. Soils, No. 25, series 1924. 72 p. illus. 1924.

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Willamette River and its tributaries are the chief drainage outlets for the area. These streams are swift and during occasional overflows do considerable damage to adjacent lands. In the western and northwestern parts drainage is effected by Siuslaw River and Long Tom River and their tributaries. These streams are sluggish, and considerable poorly drained land lies along them. Numerous small intermittent creeks ramify all parts of the area, affording good drainage except locally.

The early white settlers, on first entering this region, found the stream valleys inhabited by Indians, who pastured their livestock on the wild grasses that grew in the patches of open, treeless prairie. The streams abounded in fish, and wild game was abundant. After the open lands in the lower Willamette Valley had been occupied permanent settlements were gradually extended southward, until in 1848 the first settlement in Lane County was established at Pleasant Hill. Later settlers took up the higher terrace slopes above the river flood plains near Cloverdale School. Still others settled along the east slopes of the main valley, pushed out onto the valley floor, and finally took up the heavily forested foothills after the valley land had all been occupied. On January 28, 1851, Lane County was organized and named in honor of Gen. Joseph Lane, Territorial Governor of Oregon. The legislature in the same year passed acts for the incorporation of Portland and Oregon City.

The early population was drawn chiefly from the Eastern and Central States. At the present time slightly more than 75 per cent of the population is American born of native parentage, about 15 per cent is American born of foreign parentage, and about 9 per cent is foreign born. In the last two classes people of German extraction lead, followed in order by Danish, Greek, Norwegian, and Swedish. The foreign-born inhabitants and most of those born of foreign parents are colonized in various parts of the area.

The population of the county in 1920 was 36,166. Of this number 10,593, or 29.3 per cent, were classed as urban. The rural population had a density of 5.6 persons to the square mile. The valley areas are the most thickly populated, especially the river flood plains and the adjacent territory. The foothills are sparsely settled, and large areas of mountainous land are uninhabited. No figures on population directly applicable to the area surveyed are available, but those given will serve as a basis of comparison, as the survey covers the most thickly populated part of the county.

Eugene, the county seat and largest city in the area, had a population of 10,593 in 1920. Oregon University, located here, annually draws a transient population of 2,500 or more. Cottage Grove, in the southern part of the area, is the city next in size. In 1920 it had a population of 1,919. The many villages and settlements scattered throughout the area provide easy access to supply points and are social and religious or educational centers for the neighboring communities.

The Eugene area is unusually well supplied with transportation facilities, furnished by the main line and several branch lines of the Southern Pacific Railroad system and by the Oregon Electric Railroad (Hill system). Willamette River affords water transportation as far south as Eugene for light-draft river vessels.

The Pacific Highway, which is paved, and many well-improved macadam roads are in the area, giving year-round access to trading points. Telephones are in general use, and electricity is available in all the larger and in many of the smaller towns. Within recent years electric power lines, to furnish power for pumping and lighting, have been extended to rural districts.

Local markets handle much of the fresh fruit and vegetables produced in the area, and local canneries absorb any surplus. Surplus grain and hay and beef and dairy products find a ready market in Portland for local consumption or for transport by rail or water to outside markets. Dried prunes and hops are generally contracted for or sold through commission houses for shipment to Europe.

CLIMATE

In the Eugene area and elsewhere throughout the Willamette Valley the climate is mild, without sudden or severe changes in temperature from day to day or from season to season. On the western slopes of the Coast Range and nearer the ocean even less fluctuation in seasonal temperatures is noted. Throughout the higher elevations of the Cascade Range and in the adjacent mountainous areas the climate is more severe, and during the winter precipitation that falls as rain in the interior valleys and along the coast generally occurs as snow which may remain for several weeks or, in some of the highest places, may be perpetual, resulting in local glaciers. The coldest weather is generally experienced when the wind blows from the east or northeast over the snow-capped mountains of the Cascade Range. Owing to the influence of warm ocean currents, winds from the west are warmer.

At Eugene and elsewhere throughout the Willamette Valley the precipitation is seasonal. Ninety-eight per cent of the annual precipitation, or 37.47 inches, falls between September 1 and June 30. The mean annual precipitation at Eugene is slightly less than in the lower valley. The climate is especially favorable to the production of winter grain and forage crops, and the dry summer months afford favorable weather for harvesting grain, hay, and fruit crops. Rains are generally accompanied by southwest winds. Severe winds in the Willamette Valley are of extremely rare occurrence, though gentle breezes blowing inland from the ocean are common in the afternoons throughout the summer. Hailstorms or thunderstorms are very infrequent.

Light snowfall occurs at rare intervals during the winter in the valley, but it seldom remains on the ground for any length of time. The valley is comparatively free from damaging late spring or early fall frosts, and winterkilling of fall-planted grain is almost unknown. At Eugene the average date of the last killing frost is April 17 and that of the first October 31, giving an average frost-free season of 197 days. The latest frost recorded at Eugene occurred on June 10 and the earliest on October 4. Throughout the mountainous section of the area the dates of killing frost are generally later and earlier. The pasturing of livestock is generally limited by the wet condition of the fields rather than by severe weather conditions.

Data given in Table 1, as recorded at the United States Weather Bureau station at Eugene, are representative of climatic conditions over the greater part of the Eugene area.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Eugene*

[Elevation, 449 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1898)	Total amount for the wettest year (1902)	Snow, average depth
	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Inches*
December	41.0	66	−3	5.86	4.26	9.84	0.7
January	40.2	69	6	5.54	2.43	3.43	3.2
February	42.5	74	0	4.59	2.49	8.34	1.2
Winter	41.2	74	−3	15.99	9.18	21.61	5.1
March	45.8	76	18	4.23	1.90	4.19	1.6
April	50.4	87	26	2.69	1.99	5.49	.1
May	55.0	91	30	2.50	2.93	3.99	.0
Spring	50.4	91	18	9.42	6.82	13.67	1.7
June	60.1	94	34	1.57	1.66	.32	.0
July	65.8	99	41	.45	.12	2.37	.0
August	65.7	99	35	.49	.38	.17	.0
Summer	63.9	99	34	2.51	2.16	2.86	.0
September	60.3	93	32	2.02	3.00	.91	.0
October	53.3	84	25	2.68	1.50	1.76	.0
November	46.4	75	12	5.79	4.50	10.69	.2
Fall	53.3	93	12	10.49	9.00	13.36	.2
Year	52.2	99	−3	38.41	27.16	51.50	7.0

AGRICULTURE

Since the establishment of the first permanent settlement at Pleasant Hill in 1848 agriculture has been the dominant industry in the Eugene area. At the time of the early settlement the open valley floor and prairie region supported a luxuriant growth of grasses, and agricultural pursuits, including the grazing of sheep and cattle, naturally assumed first importance. Owing to the lack of outside markets and the scarcity of farming implements, only enough land was cultivated to supply the immediate home or community needs. With the gradual development of lines of communication, more attention was paid to the growing of grain and forage crops for sale. Vegetable and fruit crops were grown on nearly every farm, and cereal crops occupied comparatively small areas. By 1860 the greater part of the valley land had been put in cultivation, and the grazing of cattle on the open range was carried on in the foothills, where good summer pasture was available.

As the Eugene area covers only a part of Lane County, no census figures directly applicable to the area are available. However, as the area surveyed includes the greater part of the agricultural land of the county, the figures quoted will at least serve for comparison.

Table 2 gives the acreage of the principal crops, as reported by the census.

TABLE 2.—*Acreage of principal crops in Lane County, Oreg., as reported by the census*

Crop	1879	1889	1899	1909	1919	1924
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Acres*
Wheat	40,071	27,304	37,714	15,264	33,515	16,562
Oats	11,745	20,393	24,734	27,288	20,116	21,774
Barley	1,893	2,052	1,063	780	1,052	2,298
Corn	257	927	1,256	2,253	3,569	4,124
Rye	36	82	38	13	625	389
Hay and forage	[1]9,985	[1]18,848	26,931	39,164	48,220	[1]48,616
Hops	143	733	879	716	122	
Potatoes		693	1,182	2,080	1,870	1,734

[1] Hay only.

Table 3 gives farm acreages and values in census years.

TABLE 3.—*Farm acreages and values in Lane County, Oreg., for census years*

Year	Farms	Total land in farms	Average size of farms	Improved land in farms	Average value all farm property
	Number	*Acres*	*Acres*	*Per cent*	*Dollars*
1880	1,200	361,835	302.0	63.2	4,602
1890	1,707	439,200	257.0	50.9	4,550
1900	2,370	503,405	212.4	27.9	3,575
1910	2,826	485,265	171.7	32.8	8,474
1920	3,279	496,917	151.5	34.8	10,872
1925	4,168	516,735	124.0		8,822

In 1925 owners operated 85.1 per cent of the farms, tenants 14.3 per cent, and managers 0.6 per cent. In 1924 the total value of dairy products was $745,446; wool, $81,680; mohair, $24,620; eggs, $621,578; and of chickens raised, $261,859.

The present agriculture of the Eugene area consists mainly of the production of general farm crops such as wheat, oats, barley, clover, vetch, and corn. Dairying is an important source of revenue. On many farms a small herd of cows is kept to supply family needs as well as cream for sale. This practice fits in well with the general plan of farm operation and is a dependable source of income. A few farms in the main valley are devoted exclusively to the production of dairy products, and in the outlying valleys, especially on the western slopes of the Coast Range, dairying constitutes practically the only source of income. Poultry raising, fruit and nut production, and, to an increasing extent, truck gardening are playing a more or less important part in the agricultural development.

Wheat, the principal cash crop, is grown in connection with all general farm operations on the better-drained upland soils of the area. Continued cropping to wheat and other cereals had begun to result in greatly decreased yields, but with the growth of the dairy industry and the increased acreage of clover, vetch, and corn in rotation with wheat and oats, yields are improving, though they still fall short of those of early years. The wheat grown is of soft milling quality and when milled locally is blended with imported hard wheat.

The cash crop ranking next in importance is oats. This crop is sown in the spring on the more poorly drained lands or in the fall on the well-drained soils. Part of the crop is annually cut for hay. When grown with wheat or vetch oats is always used as a hay crop.

Barley is grown to some extent and harvested for grain. It is fed largely on the farm to fattening hogs or to dairy cattle. The production rarely exceeds local demands. Clover, vetch, and corn are grown almost entirely in connection with dairying. The first crop of clover is generally cut for hay, and the second is either left for seed or is pastured. Vetch is generally grown with oats and cut green as winter feed or left for hay. A small acreage is planted each year for seed, which is a valuable cash crop. Corn is either used as silage or is left to ripen as a cash seed crop.

Dairying is assuming greater importance from year to year. The dairy product generally marketed is butterfat, although the larger towns of the area afford a good market for whole milk. Butter is marketed locally and in Portland. A few small cheese-making plants are in the area, but owing to the difficulty of marketing unadvertised brands they are not prospering. The Jersey breed of cattle is well suited to local conditions and greatly outnumbers all other breeds. There is an increasing tendency to improve the herds by good breeding and by keeping individual production records.

Sheep are generally allowed to run in the mountains and on waste land in the valley during the summer and are pastured during the fall and winter on clover or grain stubble. Goats in addition to providing a valuable source of revenue in mohair, are very useful in clearing timbered lands of underbrush. They are raised largely in the foothill and mountain areas. A few hogs are raised on nearly every farm for home use, and greater numbers are kept on the dairy ranches for sale. They fit in especially well where skim milk is a by-product. Several commercial poultry farms are in the area, and a few chickens, turkeys, ducks, or geese are kept on nearly every farm. Turkeys, which are increasing in numbers each year, range over the waste land of the area.

Potatoes for sale are grown largely on the alluvial soils, though a small patch on every farm supplies home needs. Beans are grown on the sandy well-drained soils and are a valuable cash crop that fits well in the rotation with hay or grain crops.

Market gardening is becoming a more important source of income each year. Several large greenhouses in the area supply out-of-season vegetables to local and other markets. The alluvial soils are coming into more common use for vegetable production, the various products finding ready market either in the well-developed public market or through the Eugene Fruit Growers' Association, which does a large fruit and vegetable canning business. The association handles 90 per cent of the fruit and vegetables marketed in the area, with the exception of apples and prunes. The percentage of these crops handled varies from 90 per cent to less than 50 per cent.

In 1919, of the 11,286 nut trees reported in the county 11,199 were walnut trees. The Franquette walnut seems best suited to local conditions and is the leading variety. Walnuts are grown on the deep well-drained soils of the river terraces and to a slight extent on the deeper "red-hill" soils of the Olympic, Aiken, Polk, and Sites series.

Filberts are grown to some extent, one of the pioneer groves of the State being near Springfield.

Orchard fruits and small fruits are grown on nearly every farm, and there are several commercial apple, prune, and cherry orchards. Although the yield of apples is generally low the quality is good. Gravenstein, Spitzenburg, and Jonathan are the favorite varieties. In 1924 the 172,161 apple trees in the county yielded 225,149 bushels. The large Italian prune is grown almost exclusively and is of good quality. In 1924 there were 310,803 plum and prune trees in the county. Napoleon (Royal Anne), Lambert, and Bing cherries are grown largely for local consumption and for canning purposes, as they yield well and the fruit is of excellent quality. Peaches and pears are grown to some extent, there being 17,631 peach and 51,537 pear trees in the county in 1924. Peaches are generally grown on the sandy river-bottom soils and pears on the heavier hill and terrace soils.

Wheat and red clover produce best on soils of the Willamette and Chehalis series. Alsike clover and Hungarian and other vetches grow well on the more poorly drained Amity or Wapato soils and on the better areas of the Dayton soils and their dark-colored phases. The alluvial soils are intensively farmed to fruit and truck crops. Vegetables, including cabbage, lettuce, onions, tomatoes, sweet corn, watermelons, and cantaloupes, were grown for sale on 304 acres in 1924, and strawberries were grown on 343 acres.

No uniform system of crop rotation is in general use in the area, though an attempt is made to rotate crops as much as possible. Where legumes or cultivated crops are grown in connection with general farm operations a 3-year rotation is generally worked out, consisting of oats, wheat, and clover or a cultivated crop. Vetch and oats are sometimes grown in place of clover. The cultivated crop generally accompanies the legume or is worked into a 4-year rotation.

The farm buildings throughout the area are of good construction and are serviceable, but many are in need of paint or repair. Most of the farm implements are modern. The light tractor is in general favor and is extensively used. Work animals are of medium weight.

Commercial fertilizer, including lime, is little used in the area, but 276 farmers in the county reported its use in 1924. The soils are generally acid and in need of lime, which is seldom available at a reasonable price. Gypsum is frequently applied in the spring as a top-dressing to clover or alfalfa. In experiments carried on by the Oregon Agricultural Experiment Station soluble phosphates have given good returns on many of the valley soils.

On many of the larger dairy ranches farm laborers are employed throughout the year. In other branches of agriculture the demand for labor is seasonal. Many farmers exchange labor whenever possible. Most of the farm laborers are American born and are efficient. Men employed on dairy ranches are paid from $50 to $75 a month with board. During the busiest season day labor is paid from $3 to $4. In 1924, 1,612 farmers employed outside labor at a cost of $489,552.

The general practice on tenant farms is to rent on shares, the tenant furnishing livestock and equipment and receiving two-thirds of the crops. Cash rents ordinarily range from $3 to $8 an acre, but higher cash rents are demanded for well-improved river-bottom farms.

Land values are influenced by the type of soil, distance from market, and improvements. In general the best river-bottom soils are held at prices ranging from $200 to $350 an acre. Well-improved and well-drained upland soils reasonably close to market are held at prices varying from $100 to $150 an acre. Much of the more poorly drained land and hill land commands from $25 to $75 an acre. In 1925 the average value of land alone was $49.83 an acre.

SOILS

The soils of the Eugene area have developed under the influence of moderately high winter rainfall and comparatively dry summers, without extremes of summer or winter temperatures. They are seldom frozen even to a slight depth. A part of the valley soil-forming material is extremely old, and some of the deeper materials have probably been deposited by present or former streams in an inland arm of the ocean, which geologists believe at one time occupied the valley. The soils are all acid in reaction to a greater or less degree and have been leached of lime carbonate and other more or less soluble minerals.

The soils of the area are classed in four groups, as follows: (1) Soils from residual materials; (2) soils from old alluvial deposits; (3) recent alluvial soils; and (4) miscellaneous materials.

The soils developed from residual materials include only soils derived by weathering in place from consolidated rocks. Most of them are well drained, and the iron they contain is well oxidized, producing their characteristic red or rich brown colors. Iron-cemented concretions or pellets are more or less numerous in these soils as well as in some of the more poorly drained valley soils. These concretions vary in size and also in degree of cementation, but are commonly about the size of or a little larger than buckshot. Most of them can be crushed between the fingers, and under cultivation they disappear in the course of several seasons. They are thought to be a product of soil weathering of a parent material high in content of iron and colloidal materials under conditions of warm, dry summers and wet winters. Under virgin conditions most of these soils, except where shallow and exposed to the sun on southern slopes, are heavily forested. The soils of the forested areas are dull brown or dull reddish brown. The surface soils are finely granular in structure, grading into slightly compact material which continues to the horizon overlying bedrock, where the soil becomes more friable and contains quantities of partly decayed rock. In the Eugene area the rocks have been identified as basaltic, tuffaceous conglomerate, sandstone, and shale.

The basaltic rocks are of low quartz content and are termed basic. Their principal minerals, aside from quartz, are calcium, magnesium, iron, and aluminum, and some potassium and sodium are present. The soils derived from basaltic materials are members of the Aiken, Olympic, Polk, and Viola series. They occur largely in the eastern and southern parts of the area.

Throughout the southern and south-central parts of the area, associated with the basaltic rocks, is found a basaltic tuff or breccia containing a great quantity of angular, subangular, or rounded rock largely of igneous origin. The chemical composition of the rock is

practically the same as that of basalt, and the soils derived from it are also grouped largely in the Aiken and Olympic series.

Sandstones are of very common occurrence throughout the western part of the area. Shales are less common, but occur in various places associated with other sedimentary rocks. Their chemical composition is very variable, owing to their method of formation, and the soils derived from them are generally somewhat lower in soluble elements than those derived from igneous rocks. The soils derived from sandstone and shale have been classified in the Sites, Melbourne, and Carlton series.

Soils of the Aiken series have red, brownish-red, or dull-red surface soils underlain by subsoils of similar or slightly redder color. The soils are residual from basalt or other basic igneous rocks. Aiken silty clay loam is mapped.

Soils of the Olympic series are characterized by brown or reddish-brown surface soils over similar or somewhat lighter-brown or more reddish-brown subsoils. Bedrock, consisting of basic igneous rock, is generally found at a depth ranging from 30 to 40 inches, and here the soil in many places is somewhat rust brown and contains numerous fragments or chips of the underlying rock. Iron-cemented pellets and small rounded particles of weathered parent rock, commonly known as "shot," are numerous, especially in the surface soil. These soils are well drained but are apparently somewhat younger and less oxidized than associated soils of the Aiken series. Olympic clay loam, with stony and heavy phases, is mapped.

The surface soils of members of the Polk series are brown, ranging from medium brown to rich reddish brown or rather dark brown, and having, in virgin forested areas, a thin dark-colored surface layer of high organic-matter content. The structure is granular, and the material typically contains conspicuous small spherical iron-cemented pellets or concretions locally known as shot. The upper part of the subsoil is of pronounced reddish-brown or dull-red color in which the red shade is intensified under moist field conditions. This material is compact, but it breaks up into granules or small clods when dry. It is underlain by a somewhat less compact layer of dull-red or red material which grades into the underlying partly weathered bedrock. The Polk soils are of residual origin and are derived from basaltic and similar basic igneous rocks. The Polk series is represented in the Engene area by Polk silty clay loam.

Soils of the Viola series are characterized by brown or dull-brown surface layers which contain variations of grayish brown and reddish brown. The subsoils consist of heavy, plastic, impervious gray or drab clay, which continues to bedrock. These soils are generally shallow. The soils of this series are derived typically from igneous rocks, though they may include material from sandstone or shale. Viola silty clay loam is mapped.

Soils of the Sites series consist of red or brownish-red surface soils underlain by somewhat redder subsoils. These soils are residual, being derived from shale or sandstone. Directly overlying bedrock the subsoils contain considerable broken weathered fragments of the parent rock and are less oxidized, resulting in a brown or yellowish-brown color, in places mottled with red or yellow. Sites clay loam is mapped.

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The surface soils of members of the Melbourne series are brown, light brown, yellowish brown, or slightly reddish brown. The subsoils are yellowish brown, brownish yellow, pale yellow, or in places reddish yellow. The soils are residual from sedimentary rocks, chiefly sandstone and shale. Owing to the presence of partly weathered fragments of bedrock, the deeper material overlying bedrock in many places is mottled with yellow, brown, and red. Melbourne loam and Melbourne clay loam, with a red subsoil phase, are mapped.

Soils of the Carlton series have light-brown or grayish-brown surface soils overlying slightly grayer, pale yellowish-brown, or duller-brown subsoils which contain blotches or mottles of gray silty material in cavities and cracks. These soils are derived from deeply weathered sandstone or shale. Carlton silty clay loam is mapped.

The more mature soils from old alluvial materials have weathered to a greater extent than any other group of soils in the Eugene area. In the process of weathering the surface soils have been leached of readily soluble minerals and of clay and colloids which have accumulated in the subsoil and formed a compact heavy-textured layer. In some of the older terraces of the area gravel that was embedded in the soil at the time of deposition has weathered to such an extent that it offers no resistance when cut with a knife or soil hammer. Some of these soils strikingly resemble the Olympic soils in color. Under virgin conditions the soils derived from old alluvial material were partly forested and partly open prairie covered with a luxuriant growth of grasses. In some areas in which the soils are wet throughout the year they have developed a very dark-gray or black color, owing to the accumulation of organic matter. Other poorly drained areas, in which the soils are wet during a part of the year and extremely dry during the summer months, have developed a dull-gray or gray color and generally contain more or less spherical shotlike iron concretions. The well-drained virgin soils are brown or rich brown with a surface layer, an inch or more thick, containing an appreciable quantity of organic matter, which gives the surface soil when plowed a dull-brown or slightly grayish-brown color. The zone of clay and colloidal accumulation in those soils occurs at a depth ranging from 26 to 36 inches. It is underlain by the parent material at an average depth of about 52 inches. The materials from which these soils have developed are of mixed origin, being derived in part from tuffs or breccias, basalt, sandstone, and shale. Differences in age, color, drainage, origin, character of subsoil, or chemical composition have given rise to soils of the Salkum, Veneta, Willamette, Amity, Dayton, Holcomb, Salem, Clackamas, and Concord series.

Soils of the Salkum series have a surface covering, from 1 to 2 inches thick, of rich-brown light-textured material of small granular structure containing many small spherical iron concretions or pellets and much organic matter. The underlying subsurface layer, to a depth of 8 or 10 inches, consists of reddish-brown heavier-textured material of slightly compact consistence but vesicular structure which is easily broken down to a small cloddy structure. The subsoil, to a depth ranging from 24 to 28 inches, consists of reddish-brown slightly compact material of somewhat heavier texture than the overlying material. It is of pronounced vesicular structure and breaks down, on slight pressure, to a small granular or crumbly structure. Through long periods of weathering of the surface soils, clays and colloids

carried downward by percolating waters have accumulated in the subsoil. To a depth varying from 40 to 48 inches the underlying parent material is dense, compact, and heavy textured and is mottled with various shades of red, yellow, gray, and brown. The mottling is caused by the incomplete oxidation and weathering of the mass of gravel and cobbles contained in this layer. With but few exceptions the gravel is weathered to such an extent that it can be easily chopped into with a soil hammer or cut with a knife. The parent material is brownish red, friable, and lighter textured. Owing to the completely weathered gravel, it also, like the overlying horizon, is mottled. Soils of the Salkum series have been eroded and have in some measure lost their original terrace form. Salkum clay loam, with a compact subsoil phase, is mapped.

The soils of the Veneta series are similar in stage of maturity and in origin to those of the Salkum series. The surface soil, to a depth of 1 or 2 inches, consists of dull grayish-brown light-textured granular material containing a little organic matter. The subsurface soil, to a depth of 8 or 10 inches, is granular yellowish-brown material. To a depth ranging from 28 to 34 inches the upper part of the subsoil consists of yellowish-brown heavier-textured material of slightly compact consistence but of vesicular structure. The deeper part of the subsoil, to a depth ranging from 48 to 54 inches, consists of yellowish very compact dense heavy-textured material, mottled with various shades of yellow, gray, red, purple, and brown. This mottling is caused by the partial oxidation of the mass of nearly completely weathered gravel and cobbles present in the parent material. The deeper underlying parent material consists of dense but friable variegated lighter-textured material. The various weathered gravel and cobbles give rise to the variegated colors. When removed from the soil mass the gravel can very easily be crumbled in the hand. Soils of this series are derived from weathered old valley-filling deposits of great age. They are very acid and, through long periods of weathering, have been leached of much of their supply of soluble minerals. Two members of the Veneta series, the loam, with a compact-subsoil phase, and the clay loam, are mapped.

The soils of the Willamette series have developed under normal drainage conditions and are representative of the weathering conditions found in the well-drained old valley-filling soils of the Eugene area. The surface layer, to a depth of 1 or 2 inches, is loosely granular or mealy, is brown or rather dark dull brown in color and contains an appreciable accumulation of organic matter. The subsurface soil, to a depth of 8 or 10 inches, is rather dark-brown or rich-brown compact material which breaks down into clods. Weathering of the surface soil has produced a slight accumulation of clay and colloids in the underlying upper subsoil layer, but these materials are very much more evident in the lower part of the subsoil. The upper subsoil layer, to a depth ranging from 30 to 34 inches, consists of dark-brown or rich-brown slightly compact material of pronounced vesicular structure, which when dry readily breaks down into a fine granular mass when squeezed in the hand. The lower subsoil layer varies from dull-brown to slightly lighter-brown or richer-brown, heavy-textured, compact, dense material which breaks into clods. Seams or cracks in this layer are somewhat glazed by colloidal deposition and are dark tan in color. The parent material is yellowish-

brown, lighter-textured, dense but friable material which at a depth varying from 6 to 9 feet contains gravel. These soils are of mixed origin and are formed by the weathering of old unconsolidated water-laid deposits which were derived from basic igneous and sedimentary rocks. Willamette loam and Willamette silty clay loam, with a gravelly phase, are mapped.

The soils of the Amity series are characterized by granular medium-brown, dull-brown, or dark grayish-brown mellow surface soils. In virgin areas an appreciable accumulation of organic matter is present to a depth of 1 or 2 inches. This surface layer is of dull-brown or dark-brown color, and in many places it is somewhat platy in structure. The upper subsoil layer is rich-brown or dull grayish-brown moderately compact material of slightly heavier texture than the surface soil, mottled with gray, yellow, and rust brown. The lower subsoil layer below an average depth of 40 inches is less compact lighter-textured dark grayish-brown, reddish-brown, or yellowish-brown material mottled with yellow and rust brown. Soils of the Amity series are derived from the weathering of unconsolidated sedimentary deposits of mixed origin under conditions of restricted subdrainage. Amity silt loam and Amity silty clay loam, with a light-brown phase, are mapped.

The surface soils of members of the Dayton series are light brownish gray or dull brownish gray. To a depth of 1 or 2 inches the surface soil, which contains considerable organic material, is generally of somewhat pronounced brown color, of light texture, and of platy structure. Below this depth and continuing to a depth ranging from 8 to 12 inches the soil material is moderately friable and of platy structure in the upper part, grading to a cloddy structure in the lower part. The upper subsoil layer is gray or brownish-gray material of cloddy structure, mottled with rust brown and yellow. Below an average depth of 16 inches is drab plastic impervious clay containing a great quantity of colloidal material. This layer is always moist under field conditions, but when exposed to the air it breaks into coarse clods. Below an average depth of 30 inches is brownish-gray or grayish-brown lighter-textured and more friable material, mottled with gray, yellow, and rust brown. The Dayton soils are derived, under conditions of very imperfect drainage, from the weathering of alluvial deposits of mixed origin. Dayton loam, Dayton silt loam, and Dayton silty clay loam, together with dark-colored phases of the silt loam, silty clay loam, and clay, are mapped.

The Holcomb series includes soils having brown or rich-brown friable granular surface soils. The upper subsoil layers are brown, mottled with rust-brown, moderately compact material of heavier texture. At an average depth of 22 inches the deeper subsoil layers consist of grayish-drab tight plastic colloidal clay which continues to a depth of 60 or more inches. In places at a depth of 50 inches or less the subsoil is underlain by more friable material. The Holcomb soils are derived from weathered unconsolidated alluvial deposits of mixed origin. Holcomb clay loam is the only member of the series mapped.

The soils of the Salem series have rather dull-brown or light reddish-brown friable granular surface soils. Under virgin conditions the surface layer, 1 inch or more thick, contains an appreciable quantity of plant remains in various stages of decomposition, which

produce a dull-brown color. The upper part of the subsoil consists of slightly compact brown or reddish-brown material containing appreciable quantities of gravel and cobbles. The lower part of the subsoil is variable but generally is of somewhat more pronounced reddish-brown color than the surface soil and consists mainly of stratified gravel and cobbles with more or less finer interstitial material. These soils are derived largely from basalt but contain some material from sedimentary rocks. They are derived from an old valley-filling deposit that has weathered under conditions of good drainage. Salem gravelly clay loam, with a light-textured phase, is mapped.

The soils of the Clackamas series differ from soils of the Salem series in having dull-brown or dark-brown surface soils which contain a larger quantity of organic matter. The upper part of the subsoil, to a depth varying from 15 to 20 inches, is dark brown, very compact, and more or less mixed with gravel and cobbles. The deeper part of the subsoil, to an average depth of 40 inches, is very compact and of dull-brown or dark-brown color but usually of slightly richer-brown tint. The subsoils are more compact than those of the Salem soils, and the Clackamas soils have developed under conditions of poorer drainage, which is favorable to the accumulation of organic matter. The soil material is derived from a variety of rocks in which basaltic material is conspicuous. Clackamas gravelly loam and Clackamas gravelly clay loam are mapped.

The soils of the Concord series are characterized by gray or brownish-gray friable surface soils slightly mottled with yellow. To a depth of an inch or two the surface soil in places has a platy structure; the remainder of the layer is granular. The upper part of the subsoil is gray, mottled with yellow and rust brown, compact material of heavier texture than the surface soil. Numerous cavities, the size of a lead pencil or smaller, occur in the upper part of the subsoil. Most of these are lined with gray silty material. The lower part of the subsoil is slightly more compact and is of heavy texture, but it breaks up readily to a fine granular structure when subjected to considerable pressure. This layer also is mottled with yellow and rust brown. Soils of the Concord series are derived from weathered unconsolidated alluvial deposits of mixed origin, and owing to poor drainage are very poorly oxidized. Concord silty clay loam is mapped.

The recent alluvial soils are either still in the process of accumulation or have not weathered to such extent that any consistent appreciable internal modification in the profile has occurred since deposition. Under virgin conditions they are largely forested. The poorly drained areas, which were moist throughout the year, were grass covered and owing to an accumulation of organic matter have developed a dark-brown or black color. Where well drained the soils are brown or rich brown and show little or no color change or horizon of colloidal accumulation. These soils are of mixed origin and have been grouped in the Chehalis, Newberg, Camas, Wapato, and Cove series.

The Chehalis series includes soils with brown or rich-brown surface soils and subsoils. The subsoils show no compaction, and though somewhat stratified they are not consistently lighter textured than the surface soils. These soils, which are of mixed origin, are in the

process of accumulation and are overflowed at irregular intervals. Chehalis fine sandy loam, Chehalis loam, Chehalis silt loam, and Chehalis silty clay loam, with a gravelly phase, are mapped.

The soils of the Newberg series are characterized by brown surface soils overlying stratified subsoils which are consistently of light sandy texture and open porous structure. These soils are of mixed origin and have been deposited in comparatively recent times through the agency of water. They are subject to periodic overflow and are still in the process of accumulation. Newberg loamy sand, Newberg fine sandy loam, Newberg loam, and Newberg silt loam, with a heavy phase, are mapped.

Included in the Camas series are soils having rather dark dull-brown or rich-brown surface soils, overlying porous gravelly subsoils of similar or lighter-brown color. In most places the subsoils consist of a mass of waterworn gravel and cobbles in which much of the finer interstitial material consists of coarse, medium, or fine sand generally of gray or some other dark color. The Camas soils have a low water-holding capacity. They are of mixed origin but are derived mainly from basaltic rocks. These soils generally consist of old gravel bars covered by a surface deposit of soil. Camas gravelly loam and Camas gravelly clay loam are mapped.

The Wapato soils are characterized by brown or dark dull-brown surface soils containing considerable organic matter and in many places mottled with iron stains. The subsoils are brown or dark brown, mottled with gray and rust brown, and are usually of about the same texture as the surface soils. These are recent alluvial soils of mixed origin which have been deposited under poor drainage conditions. Wapato silt loam, Wapato silty clay loam, and Wapato clay are mapped.

The soils of the Cove series are characterized by dark-gray or black surface soils, overlying subsoils of similar or slightly lighter color, which are generally somewhat heavier in texture. Rust-brown mottles occur in places in the lower part of the subsoil. The deeper substratum, below a depth of 4 feet, is dull-gray or gray lighter-textured friable material mottled with rust brown and yellow. The Cove soils are recent alluvial soils of mixed origin, somewhat more weathered than other recent alluvial soils, but not sufficiently so to be classed as old valley-filling soils. They have accumulated under conditions of poor drainage favorable to the growth of vegetation and have consequently a high organic-matter content. Cove clay, with a foot-slope phase, is mapped.

Miscellaneous classifications include materials which do not fall into or which have not been differentiated into soil series and types. They include rough mountainous land, rough broken and stony land, and river wash. The last two materials are nonagricultural. Rough mountainous land includes mountainous areas not covered in detailed soil descriptions in this area.

In the following pages of this report the soils of the Eugene area are described in detail and their agricultural possibilities are discussed; the location and distribution of the different soil types are shown on the accompanying map; and their acreage and proportionate extent are given in Table 4.

TABLE 4.—*Acreage and proportionate extent of the soils mapped in the Eugene area, Oregon*

Type of soil	Acres	Per cent	Type of soil	Acres	Per cent
Aiken silty clay loam	5,952	0.7	Holcomb clay loam	12,224	1.5
Olympic clay loam	65,856		Salem gravelly clay loam	3,520	
Stony phase	4,736	8.6	Light-textured phase	2,112	.7
Heavy phase	896		Clackamas gravelly loam	2,240	.3
Polk silty clay loam	10,496	1.3	Clackamas gravelly clay loam	1,920	.2
Sites clay loam	8,640	1.0	Concord silty clay loam	3,840	.5
Melbourne loam	3,968	.5	Chehalis fine sandy loam	4,800	.6
Melbourne clay loam	50,432	9.0	Chehalis loam	10,240	1.2
Red-subsoil phase	24,512		Chehalis silt loam	10,176	1.2
Carlton silty clay loam	4,096	.5	Chehalis silty clay loam	27,776	3.6
Viola silty clay loam	5,184	.6	Gravelly phase	2,176	
Salkum clay loam	6,592	.9	Newberg loamy sand	7,168	.9
Compact-subsoil phase	1,216		Newberg fine sandy loam	6,976	.8
Veneta loam	11,008	1.7	Newberg loam	3,136	.4
Compact-subsoil phase	2,944		Newberg silt loam	4,224	.6
Veneta clay loam	4,416	.5	Heavy phase	896	
Willamette loam	3,968	.5	Camas gravelly loam	5,696	.7
Willamette silty clay loam	31,488	3.9	Camas gravelly clay loam	4,544	.5
Gravelly phase	512		Wapato silt loam	8,960	1.1
Amity silty clay loam	11,072	1.7	Wapato silty clay loam	24,576	2.9
Light-brown phase	3,008		Wapato clay	5,760	.7
Amity silt loam	1,664	.2	Cove clay	2,752	.4
Dayton loam	1,664	.2	Foot-slope phase	448	
Dayton silt loam	10,240	1.5	Rough mountainous land	363,712	43.8
Dark-colored phase	2,240		Rough broken and stony land	4,160	.5
Dayton silty clay loam	2,496	2.3	River wash	3,904	.5
Dark-colored phase	16,512				
Dayton clay, dark-colored phase	6,976	.8	Total	830,720	

AIKEN SILTY CLAY LOAM

The surface soil of Aiken silty clay loam, to a depth ranging from 8 to 12 inches, consists of red or brownish-red silty clay loam which as mapped includes some material of heavier texture. Under virgin conditions the surface soil to a depth of 1 inch or slightly more is brown or reddish brown and contains an appreciable quantity of organic matter. To a depth of 6 or 8 inches the surface soil is distinctly granular in structure and contains more or less iron-cemented pellets or concretions. With increasing depth it becomes compact or cloddy. The subsoil begins at an average depth of 10 inches and consists of clay or silty clay material which is slightly redder than the surface soil. This layer is compact and dense when moist but on drying breaks down to a coarse cloddy structure. Directly overlying the parent bedrock the soil contains many angular and partly weathered fragments of bedrock which produce rust-brown or yellowish-brown mottles. This soil is derived from the weathering of basalt and other basic igneous rocks. It is absorptive and retentive of moisture and can be maintained in good physical condition if worked under the proper moisture conditions. Field tests indicate that the surface soil is more acid than the subsoil and that it requires from 2 to 3 tons of ground limestone to the acre to neutralize the acidity.

This soil is most extensive in the northwestern part of the area on the northern boundary and a few miles south of that point. Two small areas are about 3 miles northwest of Crow in the southwestern part of the area, and a small one is near Saginaw. Fair-sized areas are near Mabel on Mohawk River.

Aiken silty clay loam occupies smooth rolling hilltops, the gentler foot slopes, and steeper hill slopes and has weathered uninterrupted

by erosion or colluvial movement. It is well drained and is generally well suited to cultivation.

The native vegetation consists largely of fir and spruce, with some oak and underbrush. Less than 10 per cent of the land is under cultivation. It is devoted to the production of wheat, oats, and clover. Wheat yields are generally low, ranging from 8 to 15 bushels to the acre, and oat yields are only slightly higher. Clover is not grown extensively, though yields are fair. Some difficulty is generally experienced in establishing a stand. Home orchards produce well, and the fruit is of good quality.

Improved areas of this soil are distant from market, and land values are comparatively low, ranging from $30 to $70 an acre. Unimproved land commands from $10 to $20 an acre.

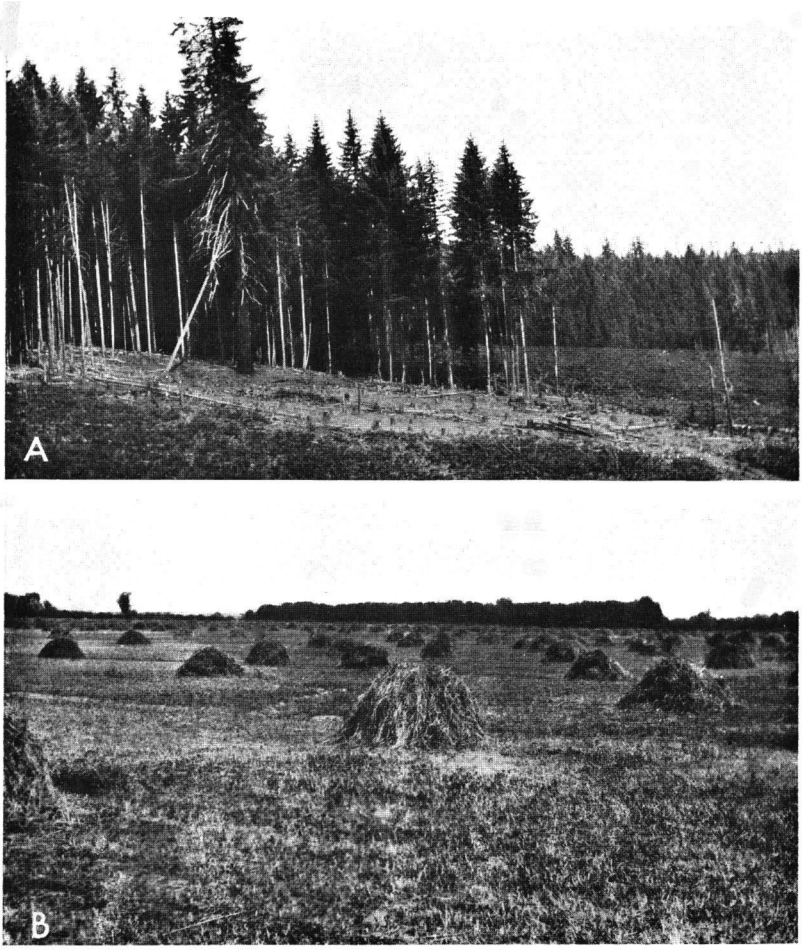
In most places crop yields are seriously reduced by the heavy growth of ferns. A rotation including a cultivated crop, such as corn, beans, or potatoes, would aid greatly in controlling this weed. Where deep, the soil is excellently suited to prunes, walnuts, and filberts. The soil can be markedly improved by turning under organic matter, preferably barnyard manure, or, where this is not available, vetch, rye, or other green crops. Soluble phosphates applied at the rate of 250 pounds to the acre have given good results.

OLYMPIC CLAY LOAM

The surface soil of Olympic clay loam, to a depth ranging from 8 to 14 inches, consists of brown, dull-brown, or light reddish-brown clay loam. To a depth of 1 or 2 inches it is very granular and contains much organic matter in various stages of decomposition; below this it is granular and contains a great many small spherical iron concretions or cemented pellets locally known as shot. The material becomes slightly compact in the lower part of the surface soil before grading into the moderately compact brown or reddish-brown clay loam or silty clay loam subsoil. Partly weathered rust-brown or yellowish-brown rock fragments are numerous in the subsoil and increase in number down to bedrock, which lies at a depth ranging from 20 to 40 inches below the surface. In local areas the basaltic bedrock outcrops, and detached bowlders occur over the surface.

In the east-central part of the area, bordering Fall and Little Fall Creeks, this soil occupies benches or terraces several hundred feet above the present valleys. Outcrops of the underlying bedrock are common, and rounded or angular bowlders and cobbles are numerous. It is thought that the soil here is derived in part from the weathered country rock and in part from old basaltic material deposited by the streams that in former times carved the elevated terraces or hanging valleys. This soil is derived in part from weathered tuffaceous conglomerate or breccia, which in places closely resembles coarse-grained sandstone, and the soil may include some material derived from sedimentary rocks. Bowlders of basaltic material are numerous in some localities, whereas in others they are entirely absent and the rock is tuffaceous.

Olympic clay loam is extensive along Coast Fork Willamette River south of Cottage Grove and along Row River. Other large bodies are in the eastern part of the surveyed area along Middle Fork Willamette, Mohawk, and McKenzie Rivers and Fall and Camp



A, Native forest cover on the Melbourne soils; B, red-clover hay on slightly undulating or nearly flat Amity silt loam

Creeks. Most of this soil lying south of Eugene in the vicinity of Spencer Butte is shallow, and rock outcrops are common.

The surface relief ranges from rolling to steep and precipitous, and some areas are too steep and broken for cultivation. Most of the soil can be easily cultivated, though care must be exercised to prevent erosion on the steeper slopes. Drainage is well developed.

The native vegetation consists of fir, spruce, and oak, with a rank growth of underbrush and ferns. From 10 to 20 per cent of the land has been cleared and is used in the production of wheat, oats, barley, clover, and a variety of fruits for home use.

Soil of this kind is easily cultivated and when supplied with organic matter is productive where of sufficient depth. Most of the deeper areas have been cropped to grain for a number of years, and crop yields are decreasing. Wheat yields from 10 to 15 bushels to the acre, oats from 25 to 35 bushels, and clover about 1½ tons. Small fruits, apples, prunes, and cherries produce well. In the shallow areas yields of wheat and oats are low, and the soil is used largely for pasture.

Improved areas of this soil are held at prices ranging from $40 to $80 an acre, depending on depth of soil, location, and improvements. Unimproved areas are valued chiefly for their timber stand and are held at prices varying from $10 to $25 an acre. Some areas near Eugene are valued for building sites and are held at much higher figures.

Under virgin conditions Olympic clay loam is well supplied with organic matter, and it is productive when first brought under cultivation. Care must be exercised to maintain the organic-matter supply. Thorough cultural methods to control ferns, which cause much trouble and loss in cultivated fields, should be practiced. Where of favorable depth the soil is well suited to the production of fruits and nuts and could be used more extensively for this purpose. The soil is acid in reaction and would require 2 or 3 tons of limestone to the acre to neutralize the acidity.

Olympic clay loam, stony phase.—The surface soil of the stony phase of Olympic clay loam consists of brown or reddish-brown clay loam which contains a great number of angular or subangular basaltic stones ranging from 6 inches to 3 feet in diameter. The subsoil consists of brown or light reddish-brown clay loam or clay which also contains a great number of stones and bowlders. Bedrock, consisting of basalt, occurs at an average depth of 24 inches but outcrops in many places.

Stony Olympic clay loam is most extensive 2 miles east of Coburg and near the junction of Little Fall and Fall Creeks. Several patches are south of Cloverdale School, and others are scattered through the mountainous parts of the area. The surface, though somewhat broken, has a gentle or moderate slope, and drainage ranges from good to excessive.

The native vegetation consists of oak and fir. Open grass-covered areas occur here and there. The soil is shallow and of low water-holding capacity, and vegetation is nowhere vigorous. With the exception of small areas devoted largely to pasture, this soil is uncultivated. It could be cleared of stone with considerable labor and expense, but owing to its shallowness it has low agricultural value

and the expense would not be warranted. The addition of organic matter and thorough cultivation would do much to improve its productiveness. Crops should be fall sown.

Land of the stony phase is not sold alone, but when sold with other soils it decreases the sale price.

Olympic clay loam, heavy phase.—The surface soil of the heavy phase of Olympic clay loam consists of brown or dark-brown clay and some included small areas of heavy clay loam. The subsoil of dark-brown heavy plastic clay rests on bedrock at a depth ranging from 20 to 45 inches. The bedrock consists of basalt or coarse-grained basic igneous rocks.

Several small areas of this soil are about 3 miles south and southwest of Eugene near the base of hills and on local foot slopes or benches. The areas are somewhat irregular but are of gentle or moderate slope. Surface drainage is good, though subdrainage is restricted.

Olympic clay loam, heavy phase, supports a growth of oaks and a few firs or pines. About 5 per cent of the land is under cultivation to hay or grain. The soil is difficult to handle, and crop yields are comparatively low. When sold with other soils this soil decreases their value.

POLK SILTY CLAY LOAM

In its virgin condition the surface soil of Polk silty clay loam, to a depth ranging from 8 to 12 inches, consists of brown or reddish-brown friable granular silty clay loam which is well supplied with organic matter. To a depth ranging from 16 to 24 inches the subsoil is slightly compact, but it breaks down to a granular structure and consists of dull-red or brownish-red silty clay loam or silty clay. The lower part of the subsoil is brownish-red or red moderately compact silty clay or clay. Basaltic bedrock occurs at an average depth of 40 inches. Iron-cemented pellets or concretions are numerous in the surface soil, but these disappear after the land has been cultivated for several years. The soil is derived from weathered basalt and other basic igneous rocks.

Polk silty clay loam is rather extensive east of the foothills and between Creswell and Cottage Grove. A large area is about 2 miles east of Fall Creek, and several patches occur in the southern and eastern parts of the area.

As this soil occurs in the mountainous parts of the area, the surface configuration is variable. In general it occupies the more gentle slopes and rounded or rolling hilltops. Drainage is good.

Under virgin conditions the land supports a vigorous growth of fir and spruce and a few oaks, with a dense growth of underbrush and ferns. About 20 per cent of the soil is under cultivation, mainly to wheat, oats, and clover. As it is deep and has good water-holding capacity, yields of wheat and oats are good, ranging from 15 to 25 bushels to the acre. Clover is grown on a small acreage as feed for dairy cows. It yields from 1 to 1½ tons of hay to the acre. Fruits and vegetables, produced for home consumption, yield well.

Improved land of this kind is held at prices ranging from $40 to $75 an acre, and unimproved land may be bought for $10 or $20.

Polk silty clay loam is well suited to fruit and nut production and could be utilized to a greater extent in this way. If more cultivated crops were grown, ferns could be largely eradicated.

SITES CLAY LOAM

The surface soil of Sites clay loam to a depth ranging from 8 to 12 inches is brownish-red or red friable granular clay loam. Numerous shotlike pellets are present in the upper part of the surface soil but they decrease in number with depth as the soil becomes more compact. At an average depth of 10 inches the subsoil consists of red silty slightly compact clay loam which becomes more compact to a depth ranging from 18 to 22 inches. The deeper part of the subsoil is dense, compact silty clay or clay which, at a depth varying from 36 to 50 inches, rests on shale or sandstone bedrock. A yellowish color is generally developed in that part of the subsoil which directly overlies the bedrock. Under virgin conditions this soil is well supplied with organic matter, and a deposit, 1 or 2 inches thick, of forest litter in various stages of decomposition covers the surface.

Sites clay loam occurs in a number of scattered areas in the hill section of the Eugene area, particularly in the western part. One of the largest areas is north of Lorane and several occur between Lorane and Cottage Grove. Other areas are west and southwest of Camas Swale, west of La Blue School, 1 mile west of Lower Camp Creek School, 2 miles southwest of Dexter, and scattered throughout developments of residual soils in the western part of the area. Most of the soil occupies gentle hill slopes and rounded or rolling hilltops. Very little of it occurs on the steeper slopes. Drainage is well developed.

About 30 per cent of the land has been cleared of its virgin growth of fir, oak, and underbrush and is utilized in the production of wheat, oats, clover, apples, and pears. Clover is grown on small acreages and yields well, though some difficulty is sometimes experienced in establishing a stand. Wheat yields from 10 to 20 bushels to the acre and oats from 15 to 30 bushels. Plantings of apples and pears are large. Owing to lack of moisture, the yields are generally small, but when the orchards are properly cared for the fruit is of good quality. Pears yield from 3 to 6 tons to the acre and are more profitable than apples, which yield from 150 to 200 bushels to the acre. The orchards are planted to vetch or rye in late August or September following the first good rain, and the cover crop is plowed under early in April. During the remainder of the season the orchards are given clean cultivation. They are sprayed and generally well cared for.

Well-improved areas in orchard are held at prices ranging from $400 to $600 an acre; land devoted to hay and grain crops commands from $40 to $70, depending on location and improvements; and cut-over land is valued at prices varying from $5 to $15, according to the cost of clearing.

Sites clay loam is a productive soil, and where the organic-matter supply is maintained and proper cultural practices are followed, crop yields are equal to those obtained on other residual soils. Areas of this soil well supplied with moisture could profitably produce prunes, filberts, and walnuts.

MELBOURNE LOAM

The surface soil of Melbourne loam, to a depth ranging from 10 to 14 inches, consists of granular brown or light yellowish-brown loam. Under virgin conditions a dull-brown surface layer, about 1 inch thick, consists largely of forest litter and partly decayed organic

material. The soil is absorptive and retentive of moisture and can be worked under a wide range of moisture conditions. The upper part of the subsoil to a depth varying from 20 to 30 inches is granular or medium cloddy dull-yellow clay loam or silty clay loam. To an average depth of 40 inches the deeper part of the subsoil consists of compact brownish-yellow or pale-yellow clay loam or silty clay loam which in many places has a pink or light-red cast. Bedrock, consisting of sandstone or shale, is exposed in few places except in artificial cuts. The surface soil is medium acid and the subsoil is strongly or very strongly acid in reaction.

This soil occurs in small tracts throughout the northwestern part of the area. Some of the largest areas border Ferguson Creek and extend southward along the foothills as far as Bear Creek. The soil occurs in the foothills, generally at the base of higher slopes and on low rounded hills and ridges. The numerous drainage ways afford good drainage throughout.

The native vegetation consists largely of fir and underbrush (pl. 1, A), but there is also some oak. About 60 per cent of the land is under cultivation to wheat, oats, clover, and fruits. Wheat yields from 15 to 20 bushels to the acre, oats from 18 to 30 bushels, and clover averages about 1 ton. The plantings of fruit are small, generally being in family orchards. However, some fruit is marketed locally. Apples, pears, prunes, and cherries produce fair yields of good-quality fruit. Some strawberries, Logan blackberries, and raspberries are successfully grown.

Well-improved land of this kind is held at prices ranging from $75 to $150 an acre. Land in general farm crops is held at prices varying from $40 to $75 an acre, depending on nearness to market and on improvements.

Melbourne loam can be improved in water-holding capacity, ease of cultivation, and productiveness by turning under green-manure crops or by adding stable manure. Experiments at the Oregon Agricultural Experiment Station show that this soil responds markedly to light applications of soluble phosphate fertilizer.

MELBOURNE CLAY LOAM

Melbourne clay loam, to a depth ranging from 8 to12 inches, consists of brown or dull-brown granular clay loam. Under virgin conditions the soil is moderately well supplied with organic matter. When properly handled it is absorptive and retentive of moisture and is easily maintained in good tilth. The subsoil is compact yellowish-brown or brownish-yellow silty clay loam, which when wet is sticky and plastic but when dry breaks down to a cloddy structure. The joints or cracks in the subsoil have glazed surfaces owing to the deposition of colloids carried down from the surface by percolating water. The underlying bedrock of shale or sandstone lies at a depth ranging from 30 to 54 inches. This is a residual soil, being derived largely from weathered fine-grained sandstone, together with some shale. As mapped it may include some material derived from tuffaceous conglomerate, which in many places closely resembles coarse-grained sandstone or conglomerate of sedimentary origin.

This soil is extensive in the western part of the area. Several large tracts are south of Eugene and in various places in the Coast

Range west of Cottage Grove, in the vicinity of Lorane and Crow, bordering Wolf and Coyote Creeks, at Hebron School, south and southeast of Pleasant Hill, and in the vicinity of Jasper. Other bodies border Row River in the southeastern part and a number of small creeks in the northwestern part of the area.

This soil occurs only in the foothills and mountainous parts of the area. Areas range from nearly level and plateaulike to steep and irregular but in general are favorable to cultural practices. Numerous creeks and intermittent drainage channels keep the soil well drained.

Under virgin conditions the land supports a valuable growth of fir and spruce, with some white and red cedars and oak. (Pl. 1, A.) The ground in forested areas is covered with ferns and low-growing brush.

About 20 per cent of the land is under cultivation, principally to wheat and oats. Wheat yields from 10 to 20 bushels to the acre and oats from 15 to 30 bushels. Clover, which is grown to some extent for hay, yields from 1 to 1½ tons to the acre. Vetch is sometimes grown with oats either for winter forage or for hay, and it yields from 1½ to 2½ tons of hay to the acre. Corn is also grown to some extent for grain and silage, but the yields obtained are somewhat less than on the valley soils. Apples, prunes, pears, cherries, strawberries, and blackberries are grown on small acreages for home use, but the yields are comparatively low. Potatoes and vegetables produced for home use yield fairly well and are of good quality.

Improved land of this kind can be bought for prices ranging from $50 to $75 an acre. Cut-over lands command from $5 to $15 an acre, and land in forest is held at a somewhat higher price, owing to the value of the timber growth.

Melbourne clay loam is a good soil and can be kept productive if good cultural practices are observed. Crop rotations to include a cultivated crop and a legume should be followed. Crop residue should be returned to the soil and every provision possible made to maintain the organic-matter supply. Best cultural practices can be observed in connection with livestock production.

Melbourne clay loam, red-subsoil phase.—The surface layer of the red-subsoil phase of Melbourne clay loam to a depth of 1 or 2 inches consists of brown or dull-brown platy loam which contains considerable organic material in various stages of decomposition. Below the surficial deposit of organic material the surface soil to a depth of 12 or 13 inches consists of brown or rich-brown clay loam which has a cloddy structure but which can be readily crushed to a fine granular condition. The upper part of the subsoil, to a depth of 20 or 24 inches, is brownish-red or yellowish-red compact silty clay loam. The lower part consists of brownish-red, red, or yellowish-red very compact clay or silty clay. At an average depth of 40 inches it rests on bedrock of shale or sandstone. When dry both the upper and lower subsoil materials break down to a medium cloddy structure.

Mapped areas of the soil of this phase may include some small areas in which the surface soil closely approaches the color of the Sites soils and areas in which the red subsoil is less pronounced than typical and that differ little from the typical soils of the Melbourne series. In very few places is bedrock exposed except in artificial cuts.

Soil of this phase occurs only in the western part of the area. The areas are of irregular outline, broken by streams and narrow bands of alluvial soils. They extend from near the northern boundary as far south as Crow. A number of small areas are in the vicinity of and north of Lorane and near Saginaw. A small area is 1½ miles northeast of Bailey School.

This land is mountainous. It occupies steep hill slopes as well as the more rounded or rolling hilltops and plateaulike areas. Drainage is thoroughly developed, and the land is well suited to cultural practices.

Under virgin conditions, a valuable growth of fir with less spruce and oak is found on the soil. A dense growth of ferns, underbrush, and briers impedes travel through uncleared areas.

This is one of the better-developed residual soils of the area. About 15 per cent of it is under cultivation, mainly to wheat, oats, clover, prunes, apples, and pears. Potatoes, corn, vegetables, and small fruits are produced largely for home use, with good yields. No set rotation is followed, owing to the small acreage of cultivated or leguminous crops grown, but an attempt is made to grow the clover, vetch, or corn crop on different fields as often as possible. Land cropped to wheat or oats for a number of years is deficient in organic matter, and as a result the soil has a tendency to dry out earlier in the summer and to run together if plowed too wet. Wheat yields range from 18 to 30 bushels to the acre on newly cleared land and from 8 to 20 bushels on land that has been in crops for a long time. The average yield of oats is about 25 bushels to the acre. Clover and vetch grown for hay yield very well in seasons of plentiful rainfall. Prunes yield from one-fourth to 1 ton of dried fruit to the acre, averaging about one-half ton. Apple orchards, when properly cared for, yield from 100 to 150 boxes of fruit to the acre. The small fruits grown are chiefly strawberries and blackberries. The last named, which grow wild in many shaded moist areas, yield abundantly.

Improved land is held at prices ranging from $50 to $85 an acre, and unimproved land in forest is valued chiefly for its timber growth. The cost of clearing stump land ranges from $50 to $100 an acre.

Soil of this phase is deep, fertile, and in good physical condition. In order to maintain its productiveness, however, a rotation which will keep down weeds must be followed, and crop residues must be returned to the soil. Dairying or other livestock industries should be extended as much as possible.

CARLTON SILTY CLAY LOAM

The surface soil of Carlton silty clay loam consists of a layer, from 1 to 1½ inches thick, of light grayish-brown heavy platy silt loam containing considerable organic matter, underlain by a 9 to 12 inch layer of dull grayish-brown or dull-brown silty clay loam of coarsely granular or small cloddy structure. The upper subsoil layer consists of light grayish-brown or pale yellowish-brown heavy slightly compact silty clay loam. The deeper subsoil layer, which is reached at a depth ranging from 20 to 26 inches, consists of light grayish-brown or pale yellowish-brown very compact silty clay continuing to a depth varying from 40 to 54 or more inches, where it rests on shale or sand-

stone bedrock. The upper subsoil layer is somewhat vesicular in structure, but the lower part is dense and compact and on drying breaks into joints forming coarse angular clods. The joints are coated with light-gray silty material or are in places dully glazed with colloids. This soil is somewhat grayer in the Eugene area than elsewhere.

Carlton silty clay loam is of only local importance. A large area is 1 mile east of Lorane, and several smaller ones are a few miles north and northeast of that place. A small area lies 1½ miles west of Laurel Home School; others occur at Richardson Butte, 1½ miles south of Central School, 2½ miles north of Noti, 1½ miles west of Crow, and at Hadleyville School; and two patches of 40 acres or less are in the eastern part of the area 1 mile east of Cloverdale School and 1 mile southeast of Waldron School.

This soil occupies positions at the foot of higher hill slopes and on low rounded ridges or knolls. Surface drainage is good, but subdrainage is somewhat restricted. The soil is well suited to cultivation.

Under virgin conditions, fir, oak, brush, and ferns occupy the land, but about 10 per cent is cleared and under cultivation. It is productive and suited to a wide range of general farm crops, such as wheat and oats. Yields of wheat range from 12 to 25 bushels to the acre, depending on the season and methods of handling, and oats produce an average of 27 bushels to the acre. Clover and vetch are grown to some extent and give somewhat better yields on this than on other residual soils.

Owing to the small size of the areas of its occurrence this soil is not sold alone. Its value is about the same as that of associated soils.

This is a naturally productive soil. It is suited to the culture of beans, potatoes, and corn, and it is suggested that these crops be worked into a rotation with wheat and oats. The dairy industry could be further extended.

VIOLA SILTY CLAY LOAM

Viola silty clay loam is characterized by a brown or dull-brown silty clay loam surface soil, from 10 to 14 inches thick, underlain by a grayish-drab plastic impervious clay subsoil which rests on bedrock of basalt or, in places, shale or sandstone, at a depth ranging from 24 to 40 inches. The surface soil is well supplied with organic matter. The subsoil, particularly in areas derived from tuffaceous conglomerate, contains materials of reddish-drab or purplish shades. Included in mapped areas of this soil are some areas with reddish-brown surface soils and some with grayish-brown surface soils.

This soil occurs in many small scattered patches in the Eugene area. A number are in the western part, generally near the heads of local drainage ways. Some of the largest areas are near the base of Spencer Butte, and small areas, most of them less than 40 acres in extent, occur in other mountainous parts of the area.

Viola silty clay loam occupies local depressions or swales near the heads of drainage ways and local benches which are subject to the accumulation of seepage water from springs and higher land. Surface drainage ranges from fair to good, but subdrainage is poorly developed throughout.

The native vegetation consists almost entirely of scrub oak and low-growing brush. Small local areas are cleared and cultivated in connection with other soils and are used largely in the production of hay and oats. Potatoes and corn are grown to some extent and give fair yields. Vegetables and small fruits produced in home gardens yield well and are of good quality.

This soil is well supplied with moisture. As it is impossible to work the land during the rainy season or until late in the spring, most of it could be improved by drainage.

SALKUM CLAY LOAM

Virgin Salkum clay loam has a surface layer from 1 to 1½ inches thick of rich-brown heavy loam of small granular structure and containing many small iron concretions or pellets and much organic matter. The subsurface layer, which is 8 or 10 inches thick, consists of slightly compact vesicular reddish-brown clay loam that breaks down to small cloddy fragments when dry. The subsoil extends to a depth ranging from 24 to 30 inches and is reddish-brown slightly compact very porous or vesicular silty clay loam or heavy clay loam which crumbles easily when pressed in the hand. This layer contains a slight accumulation of clay and colloids leached from the surface soil, but the structure remains open and porous. It is underlain to a depth ranging from 36 to 44 inches by a brownish-red or dull-red compact dense silty clay loam or clay. This material at the time of accumulation contained much gravel, which is almost completely decayed at present, and when chopped into or brought up on an auger gives to the soil a red, yellow, gray, and brown mottled appearance. Owing to the dense compact consistence of this layer, materials carried downward from the surface by percolating waters are arrested here and have become concentrated through long periods of weathering. This layer grades somewhat abruptly into the less-altered brownish-red dense yet friable silty clay parent material, mottled with various shades of red, yellow, brown, and gray. The mottling here, as in the overlying layer, is caused by the varicolored weathered gravel. The parent material grades at a still greater depth into partly weathered gravelly deposits.

Salkum clay loam is derived from weathered old valley-filling deposits of great age. The soil material has weathered under conditions of good drainage and normal soil development. As is characteristic of soils weathering under humid or subhumid conditions, this soil has developed a very strongly acid condition, and 3 or more tons of ground limestone to the acre would be required to neutralize the acidity.

Salkum clay loam is derived from remnants of eroded terrace deposits which have been weathered in place and which have a rolling or hilly relief. At the present time erosion is active only along drainage ways. Drainage is excellent throughout.

This soil is widely developed and is of considerable agricultural importance. The largest area occurs at Pleasant Hill on a high bench or terrace bordering the residual soils for a distance of several miles. Smaller areas are 1 mile south of Cloverdale School, one-half mile south of Carter, at Pengra, and along Lost Creek. A comparatively large area lies at the junction of Camp Creek and McKenzie River, and other areas in this vicinity border Camp Creek and Mohawk River near Marcola. Two areas border Coast Fork Willamette River south of Cottage Grove, and a number of patches of 60

acres or less occur in various parts of the area adjacent to the larger stream valleys.

Under virgin conditions this soil was largely open and grass covered, forests of fir and spruce occurring in only a few places. About 75 per cent of the land is under cultivation to the various crops suited to local soil and climatic conditions. Wheat and oats occupy the larger acreages. Wheat yields from 12 to 25 bushels to the acre and oats from 20 to 35 bushels. A number of dairy ranches, on which a certain acreage is annually devoted to clover and corn, are located on this soil. The first crop of clover is cut for hay, and yields varying from 1 to 2 tons to the acre are obtained. The second crop is much lighter and is either used for pasturage or is left for seed. Clover yields from 1 to 3 bushels of seed to the acre and corn from 25 to 40 bushels. Corn makes a good growth, though it is not so rank as on the alluvial stream-bottom soils, and silage yields are somewhat lower than those obtained on the river-bottom soils. Apples, prunes, cherries, and walnuts are grown, as well as a number of small fruits, including strawberries, raspberries, and blackberries. Apples yield from 100 to 200 boxes to the acre, prunes average three-fourths ton of dried fruit, and cherries produce from 3 to 6 tons, averaging 4 tons. The yield of small fruits and of vegetables produced in home gardens is good.

Salkum clay loam is a productive soil and under good cultural methods has returned profitable yields over a long period of years. A rotation of wheat, oats, and clover or corn is followed on the better farms, and crop residues and barnyard manure are regularly returned to the soil. Commercial fertilizers are not in common use, though it is a well-recognized practice to apply 50 or more pounds of land plaster to the clover crop just before the close of the rainy season, when at least one good rain may be expected to carry the mineral into the soil.

Improved land of this kind in orchards is held at prices ranging from $300 to $700 an acre, depending on location, improvements, and age of the trees. Land devoted to general farm crops is held at prices between $60 and $125 an acre, and unimproved land commands from $15 to $25 an acre.

Salkum clay loam is generally well farmed, though increased yields might reasonably be expected from a more strict observance of a 3-year or 4-year rotation which would include a cultivated crop, such as corn, potatoes, or beans. The organic-matter supply must be maintained, and the wasteful practice of burning crop residues should be abandoned. The residues should be returned to the soil. Dairying could well be further developed. This soil is suited to prune, walnut, and filbert culture, and the deeper areas could be used to greater extent for this purpose.

Salkum clay loam, compact-subsoil phase.—The surface soil of the compact-subsoil phase of Salkum clay loam consists of reddish-brown or brown clay loam from 7 to 10 inches thick. Some gravel occurs in places over the surface, and in many places the color of the soil is dark brown. The subsoil to an undertermined depth consists of compact and partly cemented gravel deposits and some finer soil separates. The gravel is only slightly weathered, compared with that in the typical soil. Areas of Salkum clay loam, compact-subsoil phase, are intimately associated with the typical soil and geologically

are apparently of the same age. They are the result of erosion or removal of the surface soil at a faster rate than weathering of the underlying gravel could proceed.

This soil is inextensive. Three bodies occur in the east central part of the area, one at Cloverdale School, another 1 mile west of Trent, and the other one-half mile south of Trent. The soil generally occupies the lower terrace slopes or borders drainage ways. The surface is undulating or rolling. Surface drainage is good, but subdrainage, owing to the compactness and imperviousness of the subsoil, is not so well developed.

The native vegetation consists almost entirely of grass with here and there a stunted oak. The soil has comparatively little agricultural value other than as pasture land. A few acres are used in the production of oats or oats and vetch for hay.

When sold alone the land is valued at prices ranging from $5 to $15 an acre. A mixture of good grasses would do much toward improving this land for permanent pasture.

VENETA LOAM

The surface layer of Veneta loam, to a depth of 1 or 2 inches, consists of dull grayish-brown granular sandy loam which contains an appreciable amount of organic matter. The subsurface layer is yellowish-brown loam from 8 to 10 inches thick. It is firm where undisturbed, but it breaks down to a granular structure as soon as it is removed from its natural position. The upper two layers have been leached of much of their finer soil material and colloids, which have been carried to the subsoil. The subsurface soil grades into the upper subsoil layer which consists of dull-yellow slightly compact but vesicular clay loam, continuing to a depth of 30 or 34 inches. Here the material grades into the lower subsoil layer, consisting of dull-yellow or pale-yellow very compact and fine heavy clay loam or clay which includes remnants of soft weathered gravel. This layer, in addition to containing the materials carried from the surface is, owing to the imperfect oxidization of the weathered gravel, mottled with gray, yellow, and reddish brown. The substratum, or parent material, is reached at an average depth of 50 inches. It consists of yellowish material containing an abundance of weathered gravel. It continues without appreciable change to an undetermined depth. In the deeper material the gravel is less weathered than near the surface. This layer consists of compact yet friable clay loam mottled with imperfectly oxidized gravel. The soil is derived from an old weathered terrace deposit of mixed origin in which, however, the sedimentary rocks giving rise to the Melbourne soils are prominent.

Veneta loam is a matured soil weathered under conditions of high rainfall and good drainage. The soil is very strongly acid and is largely leached of soluble plant-food elements. It contains little humus even under virgin conditions. Three or more tons of limestone an acre would be required to neutralize the acidity. As mapped the texture of the soil varies from light loam to heavy loam or light clay loam, and some local areas in which subdrainage is poor and the subsoil more plastic than typical have also been included. Bordering the red hill soils a surface overwash of material redder than typical occurs in many places.

Veneta loam occurs only in the western part of the Eugene area. A large tract extends south and southeast from Veneta, another borders the foothills from Elmira north to Richardson Butte, and a third occupies Fern Ridge at Alvadore.

In places, this soil has a smooth, gently sloping terrace configuration and in other places it is eroded and has a rolling, undulating, or hilly relief. Surface drainage is good, as is also subdrainage except in a few places.

The native vegetation consists of fir, oak, underbrush, and ferns. About 40 per cent of the land is cleared and under cultivation, chiefly to wheat and oats. Perhaps 100 acres is planted to apples and other fruits.

This soil is in good physical condition, but its agricultural value is not high. Wheat yields from 10 to 20 bushels to the acre and oats from 20 to 30 bushels. Difficulty is experienced in getting a stand of clover, which yields from 1 to 1½ tons to the acre. Vetch and oats yield somewhat better, producing from 2 to 3 tons of hay. The fruit produced is of good quality, though yields are generally low. A number of varieties of apples, some of which were entirely unsuited to local conditions, have been planted. The better varieties produce from 100 to 150 boxes to the acre. Judging by the condition of the few cherry, prune, and filbert trees which have been planted, the soil is better suited to these than to other fruit or nut trees.

Improved land of this kind is held at prices ranging from $60 to $150 an acre, and unimproved land commands from $10 to $25 an acre.

Veneta loam is very strongly acid and would probably respond to liming and the application of soluble phosphates. Before any attempt at improvement with commercial fertilizer takes place, however, the soil should be supplied with organic matter either by turning under vetch or rye or by the liberal application of barnyard manure. In its present condition, this soil is probably best suited to dairying, and it is believed that if the dairy industry were extended improvement to the soil through the production of more clover, vetch, and corn, grown in rotation with wheat and oats, would result.

Veneta loam, compact-subsoil phase.—The compact-subsoil phase of Veneta loam consists of a layer, from 8 to 12 inches thick, of yellowish-brown or light grayish-brown loam with a tinge of yellow, overlying an upper subsoil layer of compact yellowish-brown or brownish-yellow clay loam. The deeper part of the subsoil, lying at an average depth of 28 inches, consists of tight compact plastic clay or heavy clay loam. This material is yellowish brown, mottled with red, yellow, and gray.

Soil of this phase is not extensive. One of the largest areas is 1 mile east of Elmira, three small areas occur near Central School southeast of Veneta, an area of considerable size is one-half mile east of Waldron School, and several small areas occur near Bailey School, Crabtree Hill, Fir Butte, at Natron, one-fourth mile east of Dexter, and about 2 miles west of Cottage Grove.

Areas are smooth and gently sloping or almost flat. Surface drainage is good, but subdrainage is poor. Some areas bordering the higher hills receive considerable seepage.

The native vegetation consists of fir and oak, with a dense growth of ferns and underbrush. Less than 15 per cent of the land is under

cultivation, in connection with better soils, largely to oats, vetch, and other forage crops. Yields are somewhat lower than on typical Veneta loam.

When sold alone this soil is held at prices ranging from $45 to $70 an acre. Unimproved areas are valued largely for their timber and are priced accordingly.

The land is in need of drainage, after which the addition of organic matter is of prime importance.

VENETA CLAY LOAM

The surface soil of Veneta clay loam consists of dull yellowish-brown or light grayish-brown, mellow granular clay loam from 8 to 12 inches thick. A yellowish tint is noticeable, especially when the soil is viewed from across a field. Under virgin conditions a surface layer of organic material from 1 to 2 inches thick occurs. This is lighter textured and of duller-brown color than the surface soil in cultivated areas. The upper part of the subsoil consists of light yellowish-brown or dull-yellow slightly compact but granular silty clay loam. This layer grades into the zone of greatest illuviation, the lower subsoil layer, which begins at an average depth of 18 inches and continues to a depth ranging from 34 to 40 inches. The soil material here consists of dull yellowish-brown or dull-yellow dense compact silty clay. The underlying partly weathered parent material consists of firm moderately compact dull-yellow or pale-yellow clay loam. This material is mottled or variegated with gray, yellow, and rust brown. The mottling is caused entirely by the partly oxidized weathered gravel present in the substratum.

This is a mature soil developed under normal conditions of weathering. As is characteristic of mature soils derived from rocks of low lime content and weathered under conditions of high rainfall, it is very strongly acid throughout.

Veneta clay loam is typically developed in a large area lying north of Creswell. Two small areas border Creswell Butte and a third is 1½ miles west of that place. Several areas of 20 acres or less occur in Lynx Hollow, two areas are 1 mile south of Hebron School, a large area occurs 1 mile south of Alvadore, several smaller ones are south of this place as far as Fir Butte, and an area of 100 or more acres is 3 miles east of Springfield.

This soil is derived from a weathered old terrace deposit of mixed origin. In most places erosion has partly obscured the terrace form, leaving a rolling or hilly relief, whereas other areas retain a very marked gently sloping terrace form. A number of intermittent drainage ways ramify all areas of this soil and afford excellent surface drainage.

About 90 per cent of the land has been cleared of its native cover of fir and underbrush and is now utilized in the production of wheat, oats, clover, and various kinds of fruit. Yields of wheat range from 12 to 22 bushels to the acre, averaging 18 bushels, and oats yield from 15 to 35 bushels, with an average of 25 bushels. Clover, grown in rotation with wheat and oats, yields from 1 to 2 tons of hay to the acre and an average of 3 bushels of red-clover seed. Vetch and oats are grown on dairy ranches and yield from 2 to 3 tons of hay to the acre. A large acreage is devoted to the production of apples,

and smaller acreages are in prunes, cherries, and pears. Apples adapted to local climatic and soil conditions yield from 100 to 300 boxes to the acre, but a number of varieties are grown which are not suited to local conditions and both yield and quality are disappointing. This soil seems well suited to cherries and prunes, which give good yields. Filberts appear to offer some promise, and potatoes, corn, vegetables, and berries produce well, especially where moisture conditions are favorable.

Well-improved land of this kind in orchards is held at prices ranging from $400 to $700 an acre, depending on location, improvements, and the age and vigor of the trees. General farm lands that are well improved command from $65 to $150 an acre.

Veneta clay loam is a more productive soil than Veneta loam. Good cultural practices, including deep plowing, thorough cultivation, practice of a rotation, and the turning under of crop residues and barnyard manure, will help to maintain the soil in a good state of productivity.

Table 5 gives the results of mechanical analyses of samples of the surface soil, subsurface soil, and subsoil of Veneta clay loam.

TABLE 5.—*Mechanical analysis of Veneta clay loam*

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
561736	Surface soil, 0 to 8 inches	7.1	6.8	2.9	9.0	12.3	41.2	21.3
561737	Subsurface soil, 8 to 20 inches	2.3	5.3	3.2	10.5	11.8	40.2	26.9
561738	Subsoil, 20 to 31 inches	3.1	5.1	2.7	9.4	12.2	35.5	32.3
561739	Subsoil, 31 to 66 inches	2.6	3.4	1.6	5.6	10.2	41.1	35.4

WILLAMETTE LOAM

The surface soil of Willamette loam consists of rather dark-brown or rich-brown firm but granular loam from 8 to 12 inches thick. Under virgin conditions the surface soil to a depth of 1 or 2 inches consists of dark-colored granular loam containing much organic matter. The upper part of the subsoil is dull-brown or brown heavy loam of vesicular structure, which becomes crumbly or mealy when broken down. The lower part of the subsoil, which lies below a depth ranging from 20 to 26 inches, continues to a depth ranging from 34 to 45 inches. It consists of firm, compact, lighter-brown heavy loam or clay loam. The parent material extends to an undetermined depth and is uniform in structure and texture, except for such textural changes as may be caused by deposition. It consists of slightly compact yellowish-brown sandy loam or loam. At a great depth, generally below 9 feet, this material is underlain by stratified gravel deposits.

As mapped Willamette loam includes small undifferentiated areas of heavy loam texture and others of typical silt loam texture which join with Willamette silt loam of the Linn County survey. Another included variation consists of the typical surface soil over a subsoil of sandy loam or loamy sand. Such material is similar in all respects to the Hillsboro soils mapped in other areas of the State, but on account of its small extent it has been combined in the Eugene area with Willamette loam. The only important area of this kind is 1 mile east of Junction City.

This soil is inextensive in the Eugene area. Several small areas of silt loam texture are north of Coburg along the Linn County line. One of the largest areas is at Coburg and another is 3½ miles north of that place. A small area is one-half mile south of Lone Pine School, and another lies 1 mile northwest of Coburg. Other small areas are north and northwest of Junction City and north of Springfield. An area of 100 or more acres is 1½ miles northwest of Laurel Home School, and many others of 60 acres or less are scattered over the area in association with other old valley-filling soils.

Areas of Willamette loam range from undulating or slightly rolling to almost level, but in all places the soil is smooth enough for all cultural practices. Drainage is excellent.

Under virgin conditions this soil was partly forested but was mainly open prairie land. About 90 per cent of the land is now under cultivation, though, owing to its small extent, it is not of great agricultural importance. Wheat, oats, and clover are the principal crops grown, and small acreages are in corn, vetch, and fruit. Wheat yields from 12 to 30 bushels to the acre and oats from 20 to 40 bushels. The higher yields are largely dependent on moisture conditions. The soil dries out earlier in the summer than do the heavier members of the Willamette series. Fall-sown wheat is much more satisfactory than that sown in the spring. Oats are sown in the spring for grain and in the fall, together with vetch, for hay. Red clover is the principal variety of clover grown, and yields ranging from 1 to 2½ tons of hay to the acre are obtained. The second crop, when left for seed, yields from 2 to 4 bushels to the acre. Prunes, apples, and cherries are grown to a small extent, and the yields are only slightly less than on Willamette silty clay loam. Vegetables, small fruits, and nearly all crops suited to local conditions yield well.

When sold alone this land is held at prices ranging from $80 to $150 an acre. Some more highly improved land in orchard is held at much higher prices.

Willamette loam is easily cultivated and can be worked under a wide range of moisture conditions. It is suited to all crops grown in the area which require a well-drained soil of good physical condition and fertility. This soil would respond well to irrigation. At present most of it is well farmed, but continuous cropping to grain in the past has largely exhausted the humus supply, and it is essential that crops be rotated and crop residues returned to the soil in order to restore it to its former state of productiveness.

Table 6 gives the results of mechanical analyses of samples of the surface soil, subsurface soil, and subsoil of Willamette loam.

TABLE 6.—*Mechanical analysis of Willamette loam*

No.	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
561767	Surface soil, 0 to 9 inches	0	1.6	2.2	20.4	20.2	39.4	16.5
561768	Subsurface soil, 9 to 24 inches	.1	1.0	2.4	22.4	19.8	34.4	20.1
561769	Subsoil, 24 to 38 inches	0	.9	1.6	23.8	24.4	34.3	15.4
561770	Subsoil, 38 to 60 inches	0	.6	2.3	39.4	26.4	23.8	7.3

WILLAMETTE SILTY CLAY LOAM

The surface soil of Willamette silty clay loam has an upper layer, from 1 to 2 inches thick, of brown or dark-brown loose granular loam containing organic matter in various stages of decomposition. The subsurface layer, to a depth ranging from 8 to 11 inches, consists of rather dark-brown or rich-brown firm silty clay loam which breaks up into fine cloddy material. The surface soil is leached of readily soluble minerals and colloids. These materials are present in the subsoil, the quantity increasing with depth until the parent material is reached. The upper subsoil layer, which consists of dark-brown vesicular heavy silty clay loam that breaks into a fine granular mass on pressure, extends to a depth ranging from 30 to 35 inches, where it grades into the lower denser subsoil layer. The granules in the upper part of the subsoil are coated with a thin veneer of colloids giving them a dull glazed appearance. The lower subsoil layer, which continues to a depth ranging from 42 to 50 inches, consists of somewhat lighter-brown dense compact silty clay or light clay. This layer acts as a filter for percolating water, and in it have accumulated the materials leached from the surface layers. On drying, the soil material parts along cracks or seams. The parting planes are coated with colloids giving them a brownish-tan glazed appearance. The parent material consists of dense slightly compact yellowish-brown clay loam or silty clay loam, which continues to an undetermined depth and which is uniform in structure but of variable texture. Gravel deposits, lying at a depth ranging from 6 to 15 feet, underlie the soil in nearly all places.

This soil consists of maturely weathered old valley-filling deposits of this region which have developed under conditions of good drainage. It has not weathered to so great an extent in this area as in many counties in the lower Willamette Valley, though very little change may be expected when development is more mature. As is characteristic of soils derived from rocks low in lime and subject to long weathering or leaching under humid or subhumid conditions, it ranges from slightly acid to strongly acid in reaction. In general from 1 to 2½ tons of ground limestone to the acre would be required to correct the acidity.

Willamette silty clay loam is one of the more extensive old valley-filling soils of the Eugene area. It borders the bottom-land soils of Willamette River on the west from Eugene north to the Benton County line in an area ranging in width from 1 to 3 miles. An area of several square miles lies between Willamette and McKenzie Rivers, extending from near their junction up the McKenzie River Valley to a point 2 miles east of Thurston. Many small isolated areas occur between the hill soils on the west and the large area bordering Willamette River. Small areas, ranging from a few acres to several hundred acres in extent, occur as elevated terraces bordering all the larger and many of the smaller streams of the area. The relief varies from gently undulating or slightly rolling to almost level. The drainage ways are incised and afford complete drainage throughout the soil. Very few areas are severely eroded.

Under virgin conditions the land was partly in forest of fir and spruce, with an undergrowth of many low-growing bushes and ferns. Areas not forested supported a luxuriant growth of native grasses.

Fully 90 per cent of the land is now under cultivation. This is considered the best old valley-filling soil for agricultural purposes, and it is the most highly developed. The principal crops are wheat, oats, red clover, and oats and vetch hay. Prunes, apples, and cherries are the principal fruits grown, though small acreages are devoted to pears, peaches, Logan blackberries, strawberries, and raspberries. Several large plantings of walnuts and a few of filberts are seen.

Wheat yields were formerly much higher than at present, though good average yields are still obtained. In good seasons and under good management wheat yields from 20 to 40 bushels an acre, with an average of 25 bushels, oats from 30 to 70 bushels, and clover from 1 to 3 tons. Red clover seed yields an average of 3 bushels to the acre and oat and vetch hay from 2 to 5 tons. The yields of prunes range from 4,000 to 7,000 pounds of fresh fruit, or an average of about 2,000 pounds of dried fruit to the acre, and cherries yield from 2,500 to 5,000 pounds of fresh fruit from mature trees. The yield of apples is rather low, ranging from 100 to 250 boxes to the acre. Blackberries yield from 3,000 to 7,000 pounds to the acre, and strawberries, raspberries, and Logan blackberries give equally satisfactory yields. Corn and kale are successfully grown in connection with dairying. Walnuts yield from 1,200 to 1,500 pounds to the acre and filberts from 1,700 to 2,000 pounds.

Willamette silty clay loam is easily handled if worked under the proper moisture conditions. A 3-year rotation to include wheat, oats, and clover or vetch and oats is common.

Improved land of this kind used for general farming is held at $100 or $150 an acre, orchard lands at $400 to $700 an acre, and land planted to walnuts or filberts at somewhat higher prices.

This soil is well suited to the production of flax, and it is suggested that this crop take the place of oats to some extent, as a good market is available for both the fiber and the seed. Barley is also a better crop for spring planting than oats. It is suggested that the 3-year rotation in general use be changed to a 4-year rotation to include a cultivated crop, such as potatoes, corn, or beans. The wasteful practice of burning crop residues does not fit in with any permanent system of soil improvement and should be discouraged.

Willamette silty clay loam, gravelly phase.—The surface soil of the gravelly phase of Willamette silty clay loam consists of rather dark-brown or rich-brown gravelly silty clay loam from 8 to 12 inches thick. The gravel is of medium size and varies in quantity, though it is sufficiently abundant in all places to interfere somewhat with cultivation. The subsoil consists of an upper granular layer of gravelly silty clay loam or silty clay and a lower layer of firm compact gravelly silty clay or clay. The parent material, which is present at an average depth of 48 inches, is also gravelly, of a yellowish-brown color, and of silty clay loam or clay loam texture. Soil of this phase is differentiated from soils of the related Salem series by the absence of the more porous subsoil characteristic of that series. The gravel that occurs in this gravelly soil is embedded in the finer soil separates. As mapped some small areas of the Salem soils are included.

Soil of this phase is not extensive. Two areas lie 2 miles west of Thurston, and others occur near Cottage Grove and north of that place. The surface is undulating or nearly level, and drainage is well developed.

All this land is under cultivation, almost exclusively to wheat, oats, clover, and vetch. The yields obtained are somewhat lower than on typical Willamette silty clay loam owing to the tendency of the soil to dry out somewhat sooner. It is best suited to general farm crops, and dairying or poultry raising should fit in well with the general farm plans.

Owing to its occurrence in small areas this soil is not sold alone. It has a depressing influence on the value of the better gravel-free areas of soil with which it is associated.

AMITY SILTY CLAY LOAM

Amity silty clay loam is characterized by a light grayish-brown or dull-brown silty clay loam surface soil from 9 to 12 inches thick. The upper subsoil layer is dull-brown, grayish-brown, or yellowish-brown slightly compact silty clay loam mottled with rust brown. The lower subsoil layer, continuing to a depth of 40 or more inches, consists of light-brown or grayish-brown clay loam or silty clay loam mottled with gray, yellow, and rust brown. The soil has weathered under conditions of imperfect drainage. It is strongly acid throughout.

This soil occurs only in small scattered areas bordering drainage channels or as slight knolls within areas of more poorly drained soils. Its most extensive development is bordering the soils of the Willamette series in the vicinity of Irving and northwest of that place. A number of small areas are north of Coburg and east of Springfield; others occur along Long Tom River and between this river and the residual soils on the west; and small scattered areas are found in a number of other places associated with the upper terrace soils.

Most of this soil occurs on slight elevations surrounded by low, flat, poorly drained areas and on gentle slopes bordering soils of the Willamette series or areas of residual soils. The surface is gently sloping or nearly flat, and drainage conditions, especially of the subsoil, are poor.

This is not an extensive soil and it has no particular agricultural importance. Practically all of the land is under cultivation, with the exception of some small areas which are surrounded largely by poorly drained pasture lands. Wheat and oats are the principal crops, and smaller acreages are devoted to oats and vetch hay, clover, corn, and kale. Some small fruits, potatoes, and vegetables produced in home gardens yield well. Wheat yields from 15 to 30 bushels, with an average of 20 bushels; oats from 25 to 55 bushels, with an average of 35 bushels; clover hay from 1 to 3 tons; and oats and vetch hay from 2 to 4 tons to the acre.

Improved areas of this soil when sold alone are held at prices ranging from $80 to $125 an acre, depending on distance to market and on improvements.

Amity silty clay loam is a naturally productive soil when properly handled. It could be improved by artificial drainage, after which the addition of organic matter would prove beneficial. It is suggested that the land be used more in the production of alsike clover, Hungarian or woolly-podded vetch, and corn. Dairying could be further extended over this soil with benefit to the farmer, to the general plan of farm management, and to the soil.

Amity silty clay loam, light-brown phase.—The surface soil of the light-brown phase of Amity silty clay loam consists of rich-brown or brown friable silty clay loam, from 8 to 11 inches thick, which is normally well supplied with organic matter. The upper subsoil layer, to a depth ranging from 18 to 24 inches, is brown or rich-brown moderately compact silty clay or clay. The lower subsoil layer, continuing to an undetermined depth, consists of rich reddish-brown or dark-brown less compact clay loam mottled with gray and rust brown. In many places the subsoil contains an appreciable quantity of fine or medium gravel. Both surface soil and subsoil are acid in reaction, the acidity in the subsoil being more intense than in the surface soil.

As mapped, this soil includes one small area of clay texture, which lies about 1½ miles east of Gillespie Butte. It also includes a few small areas of somewhat lighter texture than typical. Several of these areas occur east and northeast of Coburg bordering the residual soils, and one small area is west of Willamette River one-half mile west of Howard School. Typical areas of the light-brown phase of Amity silty clay loam occur one-fourth mile north of Harpole School, one-half mile north of Walker, in the vicinity of Cottage Grove, and in the poorly drained situations bordering Long Tom River.

Soil of this phase is gently sloping or almost level. It is normally intermediate in elevation between the Willamette soils and soils of the Dayton series. Surface drainage is adequate but subdrainage is poor.

Under virgin conditions this was very largely prairie soil, covered with a luxuriant growth of wild grasses. A few areas were forested with scrub oak. About 75 per cent of the land is under cultivation, almost exclusively to general farm crops among which wheat and oats predominate. Wheat yields from 15 to 28 bushels to the acre and oats from 25 to 50 bushels. Some red and alsike clover are grown. Vetch and oats grown for hay yield from 2 to 4 tons to the acre. Corn and kale give very good yields.

Improved land of this kind is held at prices ranging from $95 to $125 an acre, and unimproved land may be had for between $15 and $30 an acre.

The chief need of this soil is drainage, after which it would be suited to a wide range of crops grown in this general region. At present it lends itself well to such crops as are grown in connection with dairying, which industry could profitably be extended on this soil. Alsike clover and Hungarian or woolly-podded vetch are the crops to which this soil is best suited.

AMITY SILT LOAM

The surface soil of Amity silt loam consists of rather rich-brown or dull-brown mellow silt loam from 8 to 10 inches thick. Under virgin conditions there is a surface deposit, 1 or more inches thick, of dull grayish-brown loam containing considerable organic matter. The subsoil consists of light grayish-brown or yellowish-brown moderately compact silty clay loam mottled with gray, yellow, and rust brown and continuing to a depth ranging from 30 to 38 inches. The lower part of the subsoil, to a depth of 60 or more inches, is less com-

pact dull-brown or light yellowish-brown clay loam mottled with rust brown and yellow.

This soil is derived from an old valley-filling deposit which has weathered under conditions of imperfect drainage. The surface soil is medium acid, and the subsoil varies from strongly to very strongly acid.

Bodies of this soil occur in the western part of the area, one-half mile south of Bear Creek, just south of Cheshire, a short distance north and east of Elmira, in the vicinity of Ward School, of Grand Prairie School, and of Clear Lake School, and in various places in association with other old valley-filling soils. Areas are smooth and gently sloping or almost level. Surface drainage is fair, but subdrainage is very much restricted. Water may occasionally stand over the surface for short periods.

Practically all this soil is under cultivation, but it is unimportant agriculturally because of its small extent. Oats, wheat, vetch, and clover are grown. Wheat yields from 15 to 30 bushels to the acre and oats from 20 to 50 bushels. Vetch is grown largely with oats on dairy farms and is cut for hay, yielding from 2 to 4 tons of hay to the acre. Both red and alsike clover are grown (pl. 1, B), but alsike is better suited to the wetter areas. Corn and kale give good yields when the ground is properly handled.

Owing to its small extent Amity silt loam is seldom sold alone. It is recognized as a productive soil and is valued at a price only slightly lower than that put on soils of the Willamette series.

The chief need of this soil is drainage. As crops grown in connection with dairying do best it would seem that dairying could be further extended. The wetter areas are well suited to alsike clover and Hungarian or woolly-podded vetch.

DAYTON LOAM

The surface soil of Dayton loam, to a depth varying from 8 to 11 inches, consists of brownish-gray or grayish-brown loam slightly mottled with yellow. It is of firm consistence and breaks down into cloddy material, containing a high content of rounded medium sand. The upper subsoil layer extending to a depth ranging from 22 to 26 inches is gray compact clay loam mottled with yellow. This layer has a slightly vesicular structure. The lower subsoil layer consists of gray or drab plastic impervious clay continuous to a depth ranging from 30 to 34 inches. The underlying parent material consists of dark-gray or grayish-brown clay loam mottled with yellow and rust brown. This material is moderately compact but can be readily crumbled to a granular structure. The soil is very strongly acid throughout. Small rust-brown iron concretions are numerous in some areas.

Dayton loam is not extensive and is of little agricultural importance. It occurs between Fern Ridge and Fir Butte.

The surface is nearly flat and is cut by shallow surface drainage ways which are so ineffective that the soil is very poorly drained and is covered by water for long periods during the rainy season.

Dayton loam is an old valley-filling soil which has developed under conditions of very poor drainage. In its virgin condition it was very largely open prairie land with only small scattered clumps of scrub oak.

Less than 5 per cent of the land is under cultivation. The cultivated areas border better-drained soils and are utilized in the production of cheat hay, oats and vetch hay, or native-grass hay. The yields obtained are low. Much of the land is used as pasture for sheep or beef cattle during the summer.

When sold alone this soil brings from $15 to $30 an acre. It is valued chiefly as pasture land.

This soil is badly in need of drainage, which can best be effected with tile. However, the cost of tile drainage is so high that under present economic conditions it is not considered justifiable. The construction of open surface ditches in many areas has proved beneficial. Erosion will naturally lower the open drains in the course of several years.

DAYTON SILT LOAM

The surface soil of Dayton silt loam consists of brownish-gray platy friable silt loam from 9 to 11 inches thick. Under virgin conditions there is a surface deposit, 1 inch or slightly more in thickness, of dull brownish-gray loose platy loam containing an appreciable amount of organic matter. The upper subsoil layer, to a depth ranging from 14 to 18 inches, consists of light-gray or dull-gray, firm cloddy silty clay loam mottled with gray, rust brown, or yellow. The deeper subsoil layer, extending to a depth ranging from 28 to 34 inches, consists of dark grayish-drab plastic impervious clay. This is underlain by the parent material, which to an undetermined depth consists of dull-brown or grayish-brown silty clay mottled with yellow and rust brown. The material is compact and breaks down to a fine granular structure.

Dayton silt loam is derived from an alluvial deposit of mixed origin which has weathered under such conditions of rainfall and poor drainage that a water-logged condition of the soil for several months of the year and an extremely dry condition of the surface soil for three or more months during the summer have resulted. Both surface soil and subsoil are very strongly acid, and the parent material is slightly less acid in reaction.

This soil is typically developed in a large area west of Fir Butte northwest of Eugene, in several smaller areas east and southeast of Fir Butte, and in two large areas near Cemetery Butte west of Junction City. Smaller areas occur near Grand Prairie School, Milorn, and Harpole School, and a large area lies on the east side of Willamette River 1 mile north of Ward School.

Areas are flat and smooth. Open surface ditches, started with a plow several years ago, have gradually been deepened by erosion until now they are in places from 6 to 8 feet deep and several feet wide. Long Tom River is very sluggish, and owing to insufficient outlet at its junction with Willamette River backwater from the river frequently stands for weeks at a time over the land. During the summer the surface soil dries out quickly.

Under virgin conditions some of this soil supported a few scattered clumps of stunted oak, and the remainder was covered with a growth of grasses. Less than 15 per cent of the land is under cultivation, and it is not valued highly for agriculture. The principal crops grown are oats, oats and vetch hay, vetch, and some alsike clover. Cheat hay and some velvet grass hay are annually cut on part of the

land. Oats yield from 15 to 30 bushels to the acre, with an average of 20 bushels; oats and vetch hay yield from 1 to 2 tons; and alsike clover yields from 1 to 2 tons of hay or from 1 to 4 bushels of seed. Areas of this soil in which tile drains have been installed are used in the production of corn, red clover, wheat, and potatoes, in addition to the crops mentioned. The yields on drained areas are much better than on undrained areas. For several years following the laying of tile drains the lines of tile can very easily be traced by the increased growth of crops. As drainage becomes more complete the soil becomes darker and crops produce a more uniform stand.

Improved undrained areas of this kind of soil are held at prices ranging from $30 to $60 an acre; the few tile-drained areas are valued much higher; and unimproved land may be bought for between $15 and $25 an acre.

The chief need of Dayton silt loam is drainage. The soil is fertile, but crop production is limited by its physical condition and by poor drainage. Tiling will correct both these conditions, but at present the cost of installing the drains is from $50 to $75 or more an acre and economic conditions do not warrant the expense. As cheat hay has a very low feeding value it is suggested that Hungarian vetch or alsike clover be substituted for this crop.

Dayton silt loam, dark-colored phase.—The surface soil of Dayton silt loam, dark-colored phase, consists of a layer from 5 to 10 inches thick of dark dull brownish-gray or very dark dull-brown friable silt loam. The upper subsoil layer consists of dull brownish-gray or dark-gray slightly compact heavy silt loam or clay loam of coarse granular structure. The deeper part of the subsoil consists of dark brownish-gray or bluish-gray tight plastic clay which contains a large amount of clay and colloids carried down from the surface soil by percolating water. The underlying substratum, or parent material, consists of yellowish-gray or yellowish-brown dense but friable silty clay loam or silt loam mottled with yellow and rust brown. Soil of this phase differs from the related and associated typical soils of the Dayton series by the darker color of the surface soil. Included with mapped areas of this soil are two small areas of loam texture, one 4 miles and the other 5 miles west of Eugene.

This soil is most extensive in the vicinity of Ward School northwest of Coburg. Several small areas are in the vicinity of Crabtree Hill and northwest of Bailey School.

Dayton silt loam, dark-colored phase, has a nearly level surface over which water stands for several days at a time during the rainy season. In the summer the soil dries out quickly and becomes hard and unmanageable unless cultivated when moisture conditions are favorable.

Less than 160 acres of this land are under cultivation. The remainder is used as pasture land. The cultivated areas, which adjoin better-drained soils, are used in the production of oats, oats and vetch hay, and alsike clover hay. Some corn is grown, and fair yields are obtained. Oats yields from 15 to 35 bushels to the acre and alsike clover hay from 1 to 3 tons. Oats and vetch hay averages somewhat higher in yield than alsike clover hay.

When sold alone land of this kind ranges in price from $15 to $35 an acre, but improved areas sold in connection with other soils are valued somewhat higher.

As with typical Dayton silt loam, drainage is the chief requirement for the improvement of this dark-colored soil. Surface drainage may be improved somewhat by deepening and straightening existing channels, though complete drainage can be effected only by means of an underground system of tile drains. After the installation of tile drains the soil should be liberally supplied with organic matter to facilitate the percolation of water. Under existing conditions the better-drained areas could be used to better advantage in the production of such legume and cultivated grass hay as is suited to poor drainage conditions.

Table 7 gives the results of mechanical analyses of samples of the surface soil, subsurface soil, and subsoil of typical Dayton silt loam.

TABLE 7.—*Mechanical analysis of Dayton silt loam*

Number	Description	Fine gravel	Coarse sand	Medium sand	Fine sand	Very fine sand	Silt	Clay
		Per cent	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
561701	Surface soil, 0 to 10 inches	0.4	1.3	0.8	3.1	5.1	69.2	19.8
561702	Subsurface soil, 10 to 16 inches	.3	.9	.6	2.5	4.5	69.4	21.7
561703	Subsoil, 16 to 34 inches	.1	.7	.8	5.1	5.4	51.9	36.4
561704	Subsoil, 34 to 60 inches	.1	1.0	2.0	15.0	15.2	35.5	31.3

DAYTON SILTY CLAY LOAM

The surface soil of Dayton silty clay loam, to a depth of 8 or 10 inches, consists of dull brownish-gray slightly compact silty clay loam. The subsoil, to a depth ranging from 28 to 34 inches, consists of dark-drab or bluish-gray plastic impervious clay. In places, the upper part of the subsoil, to a depth between 17 and 20 inches, is dull-gray silty clay mottled with yellow and rust brown. The lower part of the subsoil is light-brown or yellowish-brown silty clay loam or clay loam mottled with yellow and rust brown. This layer, though compact, is permeable and when broken down becomes granular in structure. Included in mapped areas of this soil are some small undifferentiated areas of dark-gray soil which is in reality a dark-colored phase of Dayton silty clay loam.

This soil is of mixed origin and has weathered under conditions of poor drainage. It is very strongly acid, and 2 or more tons of ground limestone to the acre would be required to neutralize the acidity.

A large area of Dayton silty clay loam is at Georgetown, a small area occurs north of Creswell in Camas Swale, and others are northeast of Creswell, and 4 miles west of Junction City.

Areas of this soil are smooth and nearly level. Local drainage ways, which are not numerous, are intrenched from 1 to 3 feet, and drainage is very incomplete. Water frequently stands over the surface for several days.

This soil has little agricultural importance, only a few acres being under cultivation to cheat hay, oats, and oats and vetch hay. The remainder of the land is used for pasture for sheep and beef cattle. Crop yields are slightly less than on Dayton silt loam.

This land is valued chiefly for grazing and brings from $15 to $30 an acre.

Complete drainage and the correction of the imperviousness of the subsoil can be effected only by laying tile drains. In many places

surface drainage could be improved by digging ditches leading into drainage ways and by lowering and straightening the main drainage outlets. Plowing narrow lands with high backfurrows and low dead furrows to facilitate surface drainage would also improve the physical condition of this soil. The production of Hungarian vetch and oat hay and alsike-clover hay could be further extended over the better areas.

Dayton silty clay loam, dark-colored phase.—The surface soil of Dayton silty clay loam, dark-colored phase, consists of a surface layer, from one-half to 1 inch thick, of dark-gray, dark brownish-gray, or dark dull-gray loose platy silt loam containing appreciable quantities of organic matter, underlain by a subsurface layer, from 6 to 10 inches thick, consisting of dull dark-gray or very dark brownish-gray silty clay loam which is of granular structure when moist but which dries out hard and intractable unless cultivated. The upper subsoil layer, which is not everywhere developed, consists of dark-gray compact silty clay loam or silty clay mottled with yellow and rust brown. It has a coarse cloddy structure when broken down, the clods breaking along joints or cracks and the surface of the clods presenting a glazed appearance which is caused by the accumulation of colloids. The material in the upper subsoil layer or in many places in the surface soil changes abruptly to the deeper subsoil material which is dark-gray or dark brownish-gray stiff impervious clay to a depth ranging from 28 to 34 inches. This deeper layer contains the weathered products of the surface soil which have been carried downward by percolating waters. The parent material is brownish-gray or dark dull-brown clay loam or silty clay loam mottled with yellow and rust brown. Though dense and compact, it is permeable and breaks down to a granular or cloddy structure when dry. Owing to the incorporation of the surface layer with the subsurface soil, this soil under cultivation appears somewhat grayer than under virgin conditions.

This soil is very strongly acid throughout. It differs from typical Dayton silty clay loam in the pronouncedly darker color of the surface soil. As mapped it includes some areas of heavier texture, approaching clay. Many areas are very dark, closely approaching the color of soils of the Cove series.

This soil occurs in a large area, broken by a few areas of better-drained soils, extending from Enid north to the county line. Many smaller areas are south of Enid, occupying narrow drainage ways. Large areas are west of Eugene and east of Coburg; small areas are near Creswell Butte, near Walker, and in the vicinity of Natron; a large area is one-half mile north of Cloverdale School; and a small area containing gravel is near Pleasant Hill.

Dayton silty clay loam, dark-colored phase, has a smooth flat surface broken only by a few shallow drainage courses. The soil is very poorly drained, and water remains over the surface for many days at a time. The ground is water-logged during the winter, but with the advent of dry weather it soon loses its moisture and becomes very hard except where cultivated.

In its virgin condition this was open grass-covered prairie land with a few clumps of stunted oak. At present it has little agricultural value, 85 per cent or more of it being used as pasture land. Under cultivation it is utilized for the production of cheat hay, alsike-

clover hay, oats, and oats and vetch hay. Some corn is grown with fair returns. Cheat hay yields from 1 to 2 tons to the acre, oats an average of 22 bushels, oats and vetch hay from 1 to 3 tons, and alsike-clover hay an average of 1½ tons.

Improved areas of this kind of land are held at prices ranging from $35 to $60 an acre, but unimproved land commands from $15 to $30 an acre.

Dayton silty clay loam, dark-colored phase, is a fertile soil, but owing to its water-logged condition throughout most of the year and to the tightness of the plastic clay subsoil it can not be utilized to good advantage. Permanent improvement is dependent on the installation of a system of tile drains. After drainage the soil should be liberally supplied with organic matter and limed in order to facilitate the movement of water. At present the soil could be improved by deepening and straightening the existing drainage channels and by plowing narrow lands with high backfurrows and low dead furrows in order to promote surface drainage. As Hungarian vetch and alsike clover can be grown successfully, it is suggested that these crops be substituted for cheat and grass hay.

DAYTON CLAY, DARK-COLORED PHASE

Typical Dayton clay was not identified and mapped in the Eugene area and is represented only by its dark-colored phase.

The surface soil of Dayton clay, dark-colored phase, consists typically of dark-gray heavy plastic clay from 7 to 10 inches thick. In places the soil is almost black and closely resembles soils of the Cove series. The subsoil consists of dark-gray heavy plastic clay containing considerable colloidal material. At a depth ranging from 35 to 42 inches the heavy plastic subsoil is underlain abruptly by dark brownish-gray clay loam or silty clay loam mottled with yellow and rust brown. This material is more friable than the surface soil or subsoil.

A large area of this phase of Dayton clay occurs in Camas Swale, another is just south of Eugene, another borders Coyote Creek above its junction with Long Tom River, and a number of smaller areas occur in various places in association with other poorly drained soils.

This soil occupies low flat areas in which drainage is very poorly developed. During the rainy season the present shallow drainage ways with their low gradient are insufficient to provide natural drainage, and water stands over the surface for many days. During the dry summer months the soil dries out quickly and owing to shrinkage numerous cracks extending to a depth of 40 or more inches form. If cultivated at the proper time, and if a mulch be maintained over the surface during the summer, the soil can be kept in fair physical condition.

Less than 5 per cent of the land is under cultivation. The cultivated areas are closely associated with better-drained soils and are used in the production of cheat hay, oats, and oats and vetch hay. Uncultivated areas are used as pasture land when the condition of the fields allows. Crop yields are less than on Dayton silty clay loam, dark-colored phase.

This soil is valued chiefly as pasture land and is held at prices varying from $15 to $30 an acre. It is seldom sold except with other soils.

Although Dayton clay, dark-colored phase, has a high water-holding capacity owing to the slowness with which moisture moves through clay soils, crops suffer quickly from lack of moisture during the summer. The heaviness of the soil makes it hard to cultivate and maintain in good physical condition. Under present conditions it is believed that attempts to improve this soil should be restricted to the deepening and straightening of the existing drainage ways in order to facilitate surface drainage. This should be followed by sowing a permanent pasture mixture. Hungarian vetch, woolly-podded vetch, alsike clover, and oats are the cultivated crops to which this soil is best suited.

HOLCOMB CLAY LOAM

Holcomb clay loam is characterized by a surface soil of dull-brown or rich-brown clay loam from 8 to 10 inches thick. The upper subsoil layer, to a depth varying from 16 to 20 inches, consists of compact brown clay loam or silty clay loam mottled with rust brown. In places the upper subsoil layer is absent, and the surface soil immediately overlies, at a depth ranging from 10 to 14 inches, the drab-gray plastic clay subsoil characteristic of the Holcomb series. This material continues to a variable depth, generally below 45 inches.

This is an old valley-filling soil of mixed origin that has weathered under conditions of poor subdrainage. It is very strongly acid throughout. As mapped it includes one small undifferentiated area of silt loam texture, occurring 1 mile south of Rock Hill.

Areas of this soil are one-half mile west of Creswell; south of Creswell, bordering Camas Swale; bordering Silk Creek, Spencer Creek, and the foothills south and west of Eugene; in the vicinity of Natron, Dexter, Divide, Redoak School, and south of Pleasant Hill; and in many of the larger intermountain stream valleys.

Holcomb clay loam occupies fanlike positions at the base of higher slopes. The smooth and gently sloping surface affords good surface drainage. Much seepage water from the higher areas enters the soil and causes poor subdrainage and the consequent formation of the stiff plastic clay subsoil which is characteristic of soils of the Holcomb series.

Under virgin conditions this soil was largely open grass-covered prairie, with here and there a clump of oak or fir trees. About 50 per cent of the land is now under cultivation. Wheat, oats, red clover, vetch and oats hay, corn, and a variety of small fruits and vegetables are successfully produced.

Wheat is grown in rotation with oats and clover or vetch and oats and produces from 15 to 30 bushels to the acre; oats produce from 20 to 55 bushels; oats and vetch hay from 1 to 4 tons, with an average of 2 tons; and red clover from 1 to 3 tons of hay or from 1 to 4 bushels of seed. Vegetables and small fruits, including Logan blackberries, strawberries, and raspberries, are produced largely in home garden plots and yield well. The soil is handled in the same manner as soils of the Willamette series, except that it can not be worked quite so early in the spring.

Improved areas of this soil are valued at prices ranging from $80 to $125 an acre, and unimproved areas can be had for $20 or $30 an acre.

The soil is productive and is suited to nearly all crops grown in the area, except the deep-rooted orchard crops. Under virgin conditions, it is fairly well supplied with organic matter, but under cultivation care must be exercised to maintain the supply by returning crop residues, applying barnyard manure, or turning under green-manure crops. Drainage conditions could be improved by the construction of cut-off drains around the base of the higher areas in order to catch seepage water.

SALEM GRAVELLY CLAY LOAM

The surface soil of Salem gravelly clay loam consists of brown or rich-brown gravelly clay loam from 8 to 12 inches thick. The subsoil is reddish-brown or light reddish-brown very compact loam or sandy loam in which great quantities of gravel and cobbles are embedded. Throughout the soil the gravel varies from one-half inch to 4 inches in diameter. It interferes to some extent with cultural practices. Below an average depth of 40 inches the subsoil is of paler-brown color, is less compact, and is pervious. The texture also is somewhat lighter.

Included in mapped areas of this soil, because of their small extent, are a few areas in which the surface soil is free or nearly free of gravel but overlies the typical subsoil. One such area is north of the place where Giddings Creek leaves the mountains, and three others lie just south of that place.

Salem gravelly clay loam occurs in a number of small widely separated areas, one of the largest and most typical of which is 1 mile northeast of Pleasant Hill. An inextensive area is 1½ miles northwest of Springfield; small areas occur in a great number of places in association with soils of the Willamette series from Eugene north to the boundary of the area; and a number of small areas are in various places in the valleys of Row River, Middle Fork Willamette River, Fall Creek, and McKenzie River.

This soil occupies terraces several feet above the present flood plains of the streams which they border. The surface is smooth, with gentle slopes. Both surface drainage and subdrainage are good or excessive.

Under virgin conditions the land was partly open grass-covered prairie and partly forested with fir or oak, but at present 90 per cent of it is under cultivation. In good seasons wheat yields from 15 to 30 bushels to the acre, but in dry seasons crops generally suffer from lack of moisture and yields are lower than on soils with heavy subsoils. Oats yield from 20 to 45 bushels to the acre, oats and vetch hay from 1 to 3 tons, and clover hay from 1 to 2 tons. In addition to the crops mentioned some corn and barley are grown. These crops yield well in favorable seasons. Vegetables and fruits produced in home gardens give good yields, particularly if given some irrigation during the dry season.

When sold alone this soil commands from $75 to $125 an acre, depending on location and improvements.

On account of the droughtiness of the land fall-sown grain does much better than that sown in the spring. It is suggested that more

barley and flax be grown for seed, taking the place of oats. Salem gravelly clay loam is an early soil and should prove well suited to the production of small fruits and vegetables. Under good management poultry raising is a profitable industry and could well be further extended. The water-holding capacity of the soil can be greatly increased by liberal applications of organic matter.

Salem gravelly clay loam, light-textured phase.—The light-textured phase of Salem gravelly clay loam to a depth varying from 8 to 12 inches consists of brown or rich-brown gravelly loam. The subsoil is brown or light reddish-brown very compact gravelly loam or clay loam. At a depth ranging from 32 to 40 inches it is underlain by brown less compact loam or in places sandy loam. This layer is pervious and contains a large quantity of loosely embedded gravel. The gravel is generally 2 inches or less in diameter and is present in sufficient quantity to interfere more or less with cultivation.

This soil is inextensive, but it occurs in a great number of widely separated areas, most of which comprise 60 acres or less. A dozen or more areas occur in the vicinity of and north of Junction City, and small areas are in many places south of that town in association with soils of the Willamette series. A comparatively large body is at Black Butte School in the extreme southern part of the area, another occurs one-half mile east of Mount Vernon School, and many small areas are in the intermountain valleys of Row River and other streams.

This soil is derived from a weathered terrace deposit of mixed origin that lies from 10 to 20 feet above the present flood plain of the streams. The surface is smooth and gently sloping, affording good or excessive drainage throughout.

Practically all of the land is under cultivation, mainly to wheat, oats, clover, vetch and oat hay, prunes, and small fruits. Yields of the various crops are somewhat lower than those obtained on typical Salem gravelly clay loam.

As this soil occurs in small areas it is not sold alone. Its value is less than that of soils having heavier subsoils.

Suggestions for the improvement and utilization of land of this kind are the same as those given for typical Salem gravelly clay loam.

CLACKAMAS GRAVELLY LOAM

The surface soil of Clackamas gravelly loam, to a depth ranging from 8 to 12 inches, consists of dark-brown gravelly loam, which in places contains a comparatively large amount of organic matter. The subsoil consists of compact dark-brown gravelly clay loam, which at a depth varying from 40 to 48 inches is underlain by dull reddish-brown very compact gravelly loam or gravelly clay loam. The gravel is largely of basaltic origin, is from 1 to 3 inches in diameter, and is rounded and waterworn. It is rather abundant in the surface soil, increases in quantity with depth, and in many places constitutes 60 per cent of the soil mass.

Included in mapped areas of this soil are a few small areas of somewhat heavier texture closely approaching silt loam. One included variation embraces soils with dark-brown gravelly silt loam surface soils containing considerable finely divided but incompletely decomposed organic matter. The result is a soil of loose fluffy con-

sistence. Here the subsoil also is looser and more porous than typical. If extensively developed this variation would have been mapped as a soil of the Sifton series, which is represented in other areas in this region. Two small areas of this included soil are three-fourths mile east of Clear Lake School.

Clackamas gravelly loam is not extensive, though it occurs in a great number of small tracts in many parts of the Eugene area. It is most typically developed in the vicinity of Clear Lake School northwest of Eugene, where more than a dozen small areas of 40 acres or less occur. A great many areas are in this same general region, occupying slight knolls surrounded by the poorly drained dark-colored phases of the Dayton soils. Several areas are near Coburg and Norkenzie School.

The soil occurs in part in small gravel deposits on elevated terraces, generally as slight knolls, and in part in local drainage ways in association with soils of the Willamette series. The surface soil is well drained, though subdrainage is somewhat restricted in local areas. This soil differs from the related Salem soils in the darker color of its surface soil and the greater compactness of its subsoil.

About 50 per cent of the land is under cultivation to wheat, oats, and oat and vetch hay. Small acreages are in corn, clover, barley, and fruit. Wheat yields about 20 bushels to the acre, oats from 20 to 50 bushels, and oat and vetch hay from 1 to 3 tons. The yields of corn, clover, and barley are slightly better on this soil than on Salem gravelly clay loam.

Land of this kind is sold only in connection with other soils because it occurs only in small areas. It is valued less highly for agriculture than the better-drained soils with heavy subsoils.

The soil is suited to the production of seed flax and barley, and it is believed that these crops would return a better income than oats. Poultry raising and dairying could be extended.

CLACKAMAS GRAVELLY CLAY LOAM

The surface layer of Clackamas gravelly clay loam consists of dark-brown granular loam, from 1 to 1½ inches thick, which contains a large amount of partly decomposed organic matter. The subsurface layer, to a depth ranging from 8 to 10 inches, is dark-brown gravelly somewhat firmer clay loam, which is of more coarsely granular structure than the layer above. The upper subsoil layer, to a depth ranging from 18 to 24 inches, is dark-brown firm compact heavy gravelly clay loam. The deeper part of the subsoil consists of dark-brown very compact heavy gravelly clay loam continuous to a depth varying from 36 to 40 inches. This layer has a red shade and shows a rather large content of colloidal material, which in many places gives the gravel particles a dark-colored stain or veneer. The parent material consists of compact dull reddish-brown loam or clay loam. The soil varies from medium to strongly acid throughout. The gravel increases in quantity in the subsoil, though there is sufficient fine interstitial material present to bind the soil and prevent excessive downward percolation of water. The gravel in the surface soil impedes cultural operations somewhat.

Clackamas gravelly clay loam is inextensive. One of the largest areas is 1 mile north of Pleasant Hill in the central part of the area,

a comparatively large area is 2 miles east of Springfield, and several smaller areas occur along the base of the mountain east of Walker.

This soil is derived from an old terrace deposit of mixed origin located several feet above the present overflow of the streams. The surface is smooth and moderately sloping, and both surface and subsoil drainage are good except in a few areas where the compact subsoil tends to retard downward percolation of moisture.

Under virgin conditions the land was very largely grass-covered prairie. About 80 per cent of it is now in cultivation, principally to wheat, oats, corn, clover, and oat and vetch hay. Wheat yields from 15 to 35 bushels to the acre, oats from 25 to 50 bushels, and clover hay from 1 to 3 tons, with an average of 1½ tons. Vegetables and fruits produced in home gardens give very good yields.

Improved areas of this soil are currently held at prices ranging from $75 to $125 an acre. Unimproved areas used as pasture land command from $20 to $45 an acre.

The best use of this soil is for the production of clover, corn, and vetch and oats for hay. It can be utilized to good advantage in connection with dairying. The supply of organic matter must be maintained to prevent lowering the moisture-holding capacity of the soil.

CONCORD SILTY CLAY LOAM

The surface soil of Concord silty clay loam to a depth ranging from 8 to 11 inches, consists of brownish-gray silty clay loam slightly mottled with yellow. This material is very firm and of vesicular structure when undisturbed, but detached clods crumble to a fine granular structure on pressure. The subsoil consists of gray compact heavy silty clay loam mottled with yellow and rust brown.

As mapped in the Eugene area Concord silty clay loam is derived from a comparatively young valley-filling deposit and has not developed a very pronounced profile. The soil is very acid throughout.

Mapped areas of Concord silty clay loam include a few small areas having a light-brown surface soil over a yellowish-brown mottled subsoil. The soil of these areas is similar to soils of the Grande Ronde series mapped in other areas in this general region.

This soil occupies low stream terraces bordering Long Tom River. One of the largest areas is one-half mile south of Smithfield, several areas border Ferguson Creek above its junction with Long Tom River, many smaller areas are in the same general vicinity, and others lie to the south along Coyote Creek.

Concord silty clay loam has a low terrace relief with a smooth nearly flat surface. Surface drainage is generally good, though water may stand over the surface for short intervals during the rainy season. Subdrainage is poor.

Under virgin conditions the land was partly prairie but was largely forested with ash, alder, vine maple, and oak. Less than 10 per cent is now under cultivation. It is used in the production of oats and oat and vetch hay. The yields obtained are very good, oats yielding from 30 to 55 bushels to the acre and oat and vetch hay an average of 2 tons.

Improved areas are currently held at prices varying from $60 to $90 an acre, and unimproved lands used for pasture command from $20 to $40 an acre.

The chief need of this soil is drainage. Much could be done toward improving the drainage by lowering and straightening the existing stream channels. After drainage, the soil should be liberally supplied with barnyard manure or other organic matter. In its present condition it is best suited to the production of oats, Hungarian vetch, woolly-podded vetch, and alsike clover. It is believed that larger areas could be farmed successfully if drainage were provided.

CHEHALIS FINE SANDY LOAM

Typical Chehalis fine sandy loam consists of rich-brown or grayish-brown mellow fine sandy loam, from 8 to 12 inches thick, overlying stratified sediments of rich-brown or brown very fine sandy loam or silt loam. In areas of the soil occurring close to stream ways the surface soils have a somewhat variable texture. In such areas the subsoils also vary in texture within very short distances, and the soil as mapped may include a few undifferentiated areas of the Newberg soils. Some of the coarser variations are of sandy loam texture and represent undifferentiated areas of Chehalis sandy loam which would have been recognized and mapped if of greater extent.

Under virgin conditions the supply of organic matter in this soil is not great, and after cultivation for several years it is generally much depleted.

This soil occurs in a great number of patches throughout the river bottoms of the Eugene area. One of the largest areas is one-half mile south of Mount Vernon School, many patches are southeast of that place bordering Middle Fork Willamette River, a number of tracts occur north of Thurston, and many others border McKenzie River. Areas bordering Willamette River from Eugene north are numerous though widely scattered, some of the larger ones being just north of Eugene, one-half mile west of Norkenzie School, near Santa Clara School, and 2 miles east of Junction City. An area in the Long Tom River bottom is at Elrus, and one borders Coyote Creek 1½ miles east of Crow. The last-mentioned areas are somewhat duller in color than typical.

The included areas of sandy loam texture are not extensive. One of the largest occurs 1½ miles southwest of Coburg, another at Deadman Ferry on McKenzie River, small areas are located one-half mile northeast of Santa Clara School, at Lancaster in the northern part of the area, one-half mile north of Oak Hill School, and one-half mile south of Landax.

The land has a smooth or slightly ridged surface. It lies from 10 to 15 feet above the normal flow of the streams, but during high water it is frequently overflowed. Both surface drainage and subdrainage are good, except during periods of overflow.

About 50 per cent of the land is under cultivation, and the remainder is forested with fir, cottonwood, ash, alder, balm, and vine maple, with other low-growing shrubs. Uncultivated areas are used as pasture land for sheep, goats, and cattle. This soil is very productive and is generally well farmed and used in the production of truck crops as well as general farm crops. Wheat, oats, corn, and red clover are the principal general farm crops. A 3-year rotation, consisting of oats, wheat, and clover, is common. A small acreage of corn is generally grown on every farm. It follows clover in the rotation and occupies part of the land usually devoted to oats.

Wheat yields from 25 to 35 bushels to the acre, oats from 35 to 65 bushels, and clover from 1 to 2 tons of hay or from 1 to 4 bushels of seed. Corn makes a rank growth and yields from 8 to 12 tons of silage or from 35 to 60 bushels of grain to the acre. Truck crops include potatoes, cabbage, cauliflower, carrots, beets, parsnips, beans, and many other vegetables. Potatoes yield from 150 to 200 bushels to the acre, cabbage from 6 to 10 tons, cauliflower from 150 to 300 crates of 12 heads each, and carrots from 15 to 25 tons. Other vegetables produce equally well. Many varieties of small fruits are grown.

Improved areas of this kind of soil are currently held at prices ranging from $90 to $200 an acre, depending largely on location with respect to overflow and on improvements. Unimproved land commands from $20 to $70 an acre.

By observing good cultural practices such as rotation of crops, addition of organic matter, and thorough cultivation, this soil can be maintained in a highly productive state. Crop residues should be returned to the soil. Very much better results from the application of commercial fertilizer can be obtained if the soil is well supplied with organic matter.

CHEHALIS LOAM

The surface soil of Chehalis loam is brown or rich-brown mellow loam from 9 to 12 inches thick. The subsoil consists of brown or rich-brown stratified sediments ranging in texture from very fine sandy loam to clay loam. In general the texture of the subsoil to a depth of 4 or more feet is the same as or slightly heavier than that of the surface soil. Many areas of this soil in the western part of the Eugene area were formed by outwash from sedimentary rocks and are light brown, tinged with yellow when dry, but when wet are brown or rich brown. As mapped this soil includes a few small areas in which both surface soil and subsoil materials are gravelly. Such areas are indicated on the map by gravel symbols.

Chehalis loam occurs in many parts of the Eugene area, bordering the small intermountain streams, and in the larger valleys. It is extensive along upper Lake Creek, along Wolf Creek, and in the Coyote Creek bottoms. A number of small areas border Mosby Creek and Row River, and many areas ranging in size from 10 to 160 acres are in the McKenzie River bottom, particularly from Thurston east. Most of the gravel-free areas of the Chehalis soils bordering Fall Creek, Little Fall Creek, and Winberry Creek are Chehalis loam. Several small areas border Coast and Middle Forks Willamette River; an area is on the upper forks of Bear Creek; one is on a small creek north of Noti; several are east of Cottage Grove on Row River; one is one-half mile east of Walker; and others are one-half mile west of Springfield. A few small areas are in the Willamette River bottom between Eugene and the county line. A few very small gravelly areas occur 1¾ miles east of Creswell, 1½ miles east of Walterville, and bordering Row River.

The surface of this soil is smooth and gently sloping in the direction of stream flow. Owing to varying currents in time of flood the surface of areas bordering the larger streams is somewhat billowy or ridged. The land is overflowed almost every year, but as soon as the water subsides drainage is quickly effected and the soil is soon in condition to be worked.

The native vegetation consists of fir, oak, willow, alder, cottonwood, and ash, with many low-growing trees and bushes. About 60 per cent of the land is under cultivation, principally to feed crops. Wheat is a cash crop grown on many of the farms in the larger valleys near markets. Corn yields from 20 to 40 bushels to the acre of grain and from 10 to 12 tons to the acre of silage. Oats are grown both for feed and as a cash crop. Yields of this crop are from 30 to 70 bushels to the acre. Oats and vetch and red and alsike clovers are grown for hay. Kale is grown as a winter succulent for dairy cows and for poultry. It yields from 15 to 30 tons to the acre. Many small areas of this soil located near markets are used in the production of small fruits and vegetables. Raspberries yield from 1,000 to 2,500 pounds to the acre, Logan blackberries from 2,000 to 4,000 pounds, and other blackberries from 3,000 to 6,000 pounds. Squash yields from 8 to 11 tons and cucumbers from 2 to 4 tons. Crop yields on the gravelly areas are somewhat less than on the typical soil.

Well-improved areas of this soil are currently held at prices ranging from $150 to $250 an acre, but some well-improved areas distant from market may be had for slightly less. Unimproved land ranges in value from $40 to $80 an acre.

Chehalis loam is well farmed, and under present farming practice it should continue to produce profitable crops for an indefinite period of time. It could be more extensively used for the production of truck, fruit, and nut crops, particularly filberts.

CHEHALIS SILT LOAM

The surface soil of Chehalis silt loam, to a depth varying from 9 to 12 inches, consists of brown or rich-brown smooth-textured silt loam. The subsoil is stratified and may consist of either brown silt loam, loam, or clay loam somewhat lighter in color than the surface soil. The surface soil varies somewhat in texture in local areas, owing to deposition of sediments by varying currents of water in time of overflow. The soil is moderately well supplied with organic matter. In common with other recent alluvial soils it is slightly or medium acid in reaction, and from 1 to 2 tons of ground limestone to the acre would be required to neutralize the acidity.

Chehalis silt loam is rather extensive in the Eugene area, occurring in all the larger stream valleys. Some of the largest areas are in the Siuslaw River bottom, others border Coast Fork Willamette River south of London, and others are along Long Tom River and Ferguson Creek. A number of comparatively large areas border Middle Fork Willamette River, particularly in the vicinity of Natron and west of that place and north of Trent. Many small areas are in the valley of McKenzie River and several are in the Mohawk River Valley. Areas are south of Coburg, at Stumptown, and in the Willamette River bottom between Eugene and the north county line.

This soil is comparatively important agriculturally. About 65 per cent of it is under cultivation, and the remainder is forested with fir, cottonwood, ash, alder, and balm. Willows, vine maple, dogwood, and many other low-growing bushes and trees form a dense undergrowth in areas which border the larger streams. The uncleared areas are used as pasture land for sheep and cattle. Wheat, oats, clover, oat

A, Corn growing on Chehalis silty clay loam. Typical farmstead and farm buildings in distance; B, Logan blackberries on Chehalis silty clay loam

and vetch hay, and corn are the principal crops grown. Much of this land in the vicinity of markets is used in the production of truck crops and tree, vine, and cane fruits.

Chehalis silt loam is suited to a wide range of crops and under proper management good yields are obtained. Wheat yields from 25 to 45 bushels to the acre, with an average of 30 bushels, oats yield from 45 to 75 bushels, corn from 30 to 65 bushels, oat and vetch hay from 2 to 5 tons, clover from 1½ to 3 tons, potatoes from 200 to 250 bushels, squash from 10 to 12 tons, cabbage from 7 to 11 tons, strawberries from 150 to 200 crates, and prunes from one-fourth to 1½ tons of dried fruit. In addition to the fruits and vegetables mentioned many others are grown with equal success.

Vegetable-producing lands are intensively farmed and are generally given some fertilization. Barnyard manure is applied where available, and complete commercial fertilizers are used on much of the vegetable land and land devoted to small fruits. A cover crop of vetch is grown in the better-managed orchards and turned under in late March or April. The orchards are then clean cultivated. On areas of this soil devoted to general farming a 3-year rotation of oats, wheat, and clover is followed.

Chehalis silt loam, where highly developed and well improved, is currently held at prices ranging from $150 to $350 an acre. Unimproved areas may be bought at a price ranging from $30 to $80 an acre.

Chehalis silt loam is well suited to fruit, vegetable, and nut culture, and greater use could be made of it for these purposes. More poultry and hogs should be kept in order to eliminate waste of grain screenings, garbage, and unmarketable fruit and vegetables. Hog production is generally very profitable, and it is suggested that more hogs be kept for hogging off corn and pasturing clover sod. Alfalfa will grow well on this soil and if properly handled should yield from 3 to 5 tons of hay to the acre. The soil is well suited to flax grown for fiber or for seed.

CHEHALIS SILTY CLAY LOAM

To a depth ranging from 9 to 12 inches the surface soil of Chehalis silty clay loam consists of rich-brown or brown mellow silty clay loam which is moderately well supplied with organic matter. The subsoil is light-brown or brown clay loam or silty clay loam, which is uniform in texture and structure to a depth of 5 or more feet. In the western part of the area, where the soil is derived largely from outwash material from sedimentary rocks, it is light brown tinged with yellow or gray. The surface soil is medium acid and the subsoil is slightly acid.

This is one of the most extensive recent alluvial soils in the Eugene area. A large area is near Santa Clara School, another is 1 mile east of Junction City, another just north of Eugene, and others at Noraton School and near Riverview School. The largest area occupies the valley of Mohawk River. A large area is at Dexter, another at Jasper, and many others are in this same vicinity. The bottom lands bordering Coast Fork and Middle Fork Willamette River, Row River, Mosby Creek, and Lost Creek are largely of this soil.

The surface of the soil is smooth with a gentle slope toward the stream and in the direction of stream flow. The land is subject to overflow at periodic intervals, though not so often as some other recent alluvial soils. Except during overflow drainage is excellent.

This is one of the more important soils of the area. About 80 per cent of it is under cultivation, principally to wheat, oats, oats and vetch, clover, and corn. The remainder is forested with fir, oak, cottonwood, ash, and alder. Wheat and oats are cash crops, and oat and vetch hay, clover hay, and corn are grown largely as feed for dairy cows. (Pl. 2, A.) Some clover seed and seed corn are grown each year as cash crops. Beans, alfalfa, barley, and vetch grown for seed occupy small acreages each year. Truck crops consist largely of potatoes, cabbage, melons, tomatoes, squash, carrots, beets, cauliflower, spinach, string beans, and cucumbers. Prunes, apples, cherries, plums, peaches, and pears are grown, as well as many small fruits such as strawberries, raspberries, gooseberries, and Logan and other blackberries. (Pl. 2, B.)

The soil is productive, and the crops grown produce abundantly when given proper care and attention. Wheat yields from 25 to 45 bushels to the acre, oats from 45 to 85 bushels, corn from 10 to 14 tons of silage or from 40 to 70 bushels of grain, red clover from 1 to 3 tons of hay or from 2 to 7 bushels of seed, and oats and vetch from 2 to 6 tons of hay. Alfalfa grown under good management yields an average of 4 tons of hay to the acre. The yields of truck crops are good, cabbage yielding from 8 to 12 tons to the acre, squash from 10 to 14 tons, cucumbers from 4 to 5 tons, carrots from 25 to 30 tons, spinach from 4 to 6 tons, and string beans from 2½ to 4 tons. Fruits produce well, and the trees, canes, or vines are in a vigorous state of growth. Cherries yield from 3,000 to 5,000 pounds of fruit to the acre, Logan blackberries from 2 to 4 tons, strawberries from 150 to 250 crates, and prunes from one-half to 1½ tons of dried fruit.

Fruits and berries are produced largely without irrigation, but in recent years truck crops have been irrigated to a considerable extent and yields have increased greatly. The methods of handling the general farm crops are the same as those given for crops on Willamette silty clay loam. Land of this kind used for vegetable production is fertilized with barnyard manure where available, and a green-manure crop of vetch is plowed under by some farmers. Various commercial fertilizers are used, generally a complete fertilizer. Where the materials are used separately on truck soils or those devoted to berry production, from 100 to 250 pounds of sodium nitrate, from 50 to 100 pounds of potash, or from 200 to 500 pounds of superphosphate are applied to the acre. Potash and nitrate applications are made in the spring at the time of plowing. Gypsum is frequently applied, at the rate of 50 pounds to the acre, to clover and alfalfa fields in the spring just before the last good rain may be expected.

Improved land of this kind currently commands from $200 to $400 an acre, orchard lands bring somewhat higher prices, and unimproved land may be bought for from $40 to $80 an acre.

This is a naturally productive soil and is easily handled if worked under proper moisture conditions. Probably the best way of maintaining the productiveness of the soil is by frequent applications of barnyard manure, as the best and most economical results with com-

mercial fertilizers are never obtained unless the soil is well supplied with organic matter. A larger area could be irrigated at small expense for installation of pumps and equipment.

Chehalis silty clay loam, gravelly phase.—The surface soil of the gravelly phase of Chehalis silty clay loam consists of brown or light reddish-brown gravelly silty clay loam from 8 to 12 inches thick. The subsoil is brown or light reddish-brown gravelly clay loam or gravelly silty clay loam. The gravel is of medium size and is evenly distributed throughout. In small areas this soil may have a leachy, porous gravelly subsoil. If extensive, such soil would be mapped as a member of the Camas series.

This gravelly soil is not extensive. Several small areas are in the Mohawk River Valley, a number of areas border Coast Fork Willamette River south of Cottage Grove, a number are in the valley of Row River, and others are south of Creswell.

The land has a smooth surface with sufficient slope to provide good drainage. It is overflowed at intervals, but it dries out quickly and can be worked in a very short time after an overflow.

This soil is utilized largely in the production of wheat, oats, clover, and oat and vetch hay. A few small areas are devoted to the production of prunes, pears, and small fruits. Yields are somewhat less than on typical Chehalis silty clay loam.

As the gravelly phase of Chehalis silty clay loam occurs in small areas it is not sold alone. Its value is less than that of the gravel-free areas of the soil.

Suggestions for the improvement and utilization of this soil are the same as those given for the typical soil.

NEWBERG LOAMY SAND

The surface soil of Newberg loamy sand consists of brown or light-brown loamy sand from 8 to 12 inches thick. The subsoil is stratified and extremely variable in texture. Below a depth between 30 and 40 inches it is underlain by deposits of gravel and sand. The upper part of the subsoil is coarse, medium, or loamy sand. Included in mapped areas of this soil are small areas having a sandy loam or loamy fine sand texture, but such areas are of very irregular occurrence and could not be differentiated on the map.

Newberg loamy sand is rather extensive 1 mile east of Lone Pine School in the north-central part of the area. A great number of small patches border Willamette River from Eugene north to the county line, and other areas border McKenzie River, Middle Fork and Coast Fork Willamette River, and Row River.

The surface of Newberg loamy sand is furrowed or ridged. This soil occurs along the larger streams only slightly above river wash and is overflowed annually. Drainage is excessive except during overflow.

As the soil is subject to reworking with each successive flood, it has no particular agricultural value other than for the grazing it affords. The only areas under cultivation are small and are associated with more productive soils. Under virgin conditions the land is forested with willow, alder, ash, vine maple, cottonwood, and balm.

When sold alone the land is currently valued at $10 or $20 an acre. It is best left in forest, in order to protect the higher soils from erosion.

NEWBERG FINE SANDY LOAM

The surface soil of Newberg fine sandy loam, to a depth varying from 8 to 14 inches, typically consists of rich-brown or light reddish-brown fine sandy loam. The subsoil is somewhat stratified but is invariably lighter in texture than the surface soil. It consists of rich-brown or light reddish-brown loamy sand or fine sand. The surface soil is medium acid, but the subsoil is only slightly acid. The texture of the surface soil is somewhat variable, ranging from sandy loam to silt loam. Such variations are small and of irregular occurrence and could not be differentiated on the map.

This soil occurs only along the larger streams of the area, near the present channels or channels that have recently been abandoned. One of the largests areas is 1 mile east of Eugene. Many areas border Mc Kenzie River from Deadman Ferry east. A typical area lies three-fourths mile northwest of Cedar Flat School. Very little of this soil occurs along Willamette River north of its junction with Mc Kenzie River, but a number of areas are south of Eugene, near Walker, and east of Cottage Grove. A great many areas border Middle Fork Willamette River.

The surface of this soil is billowy or ridged. The land is overflowed with each successive high-water stage of the river along which it occurs, and the surface is subject to considerable reworking by varying currents. Drainage ranges from good to excessive except during periods of overflow.

This soil is of only local importance, and less than 30 per cent is under cultivation. Uncultivated areas are forested with fir, cottonwood, willow, alder, ash, and many other trees and bushes. Under cultivation the land is used in the production of wheat, oats, corn, potatoes, melons, cabbage, carrots, beets, beans, and many other fruit or vegetable crops.

This soil is more droughty than soils of the Chehalis series, and yields are not always good. Wheat yields from 15 to 35 bushels to the acre, oats from 20 to 50 bushels, potatoes from 100 to 200 bushels, cabbage from 6 to 10 tons, and carrots from 15 to 20 tons. Other vegetable and melon crops yield well in favorable seasons.

Improved land of this kind currently commands from $100 to $175 an acre, and unimproved land may be had for from $40 to $70 an acre.

The chief need of this soil is protection from overflow. At present the land can best be used in the production of summer annuals or crops which will bind the soil and protect it from erosion. The soil is productive and would respond well to irrigation.

NEWBERG LOAM

The surface soil of Newberg loam consists of brown or rich-brown mellow loam from 9 to 14 inches thick. The subsoil is lighter in texture than the surface soil and consists of brown or light reddish-brown sandy loam or loamy sand. Under virgin conditions the surface soil is moderately well supplied with organic matter, but under cultivation this is soon lost. The soil is subject to slight reworking during high water, and the texture of the surface soil may vary sharply within very short distances. The material is of mixed origin, prbably largely from basalt.

This soil occurs in a number of patches scattered throughout the bottom lands bordering the larger streams of the area. A tract is 1 mile east of Noraton School, another one-half mile east of Riverview School, two about three-fourths mile east and northeast of Lone Pine School, and several others between this place and Eugene. On McKenzie River several areas occur near Armitage and Coburg, and a few small areas border the river between Coburg and the eastern boundary of the area. A few small areas are east of Goshen along Coast Fork Willamette River.

Areas of this soil have a ridged or billowy relief. The land is subject to overflow with each successive period of high water. Drainage ranges from good to excessive. Following overflow the soil dries out quickly and can be worked within a few days after the water subsides.

About 40 per cent of the land is cultivated and the remainder is forested with oak, fir, cottonwood, willow, alder, and ash. The cultivated areas are used in the production of wheat, oats, clover, fruit, and vegetables. The sandy subsoil breaks capillarity somewhat, and the soil dries out more quickly than soils having heavy subsoils. Wheat yields from 20 to 35 bushels to the acre, oats from 35 to 60 bushels, and clover hay from 1 to 2 tons. Yields of vegetables and fruits are somewhat better than on Newberg fine sandy loam.

Improved areas of this soil are held at prices ranging from $100 to $200 an acre, and unimproved areas can be had for the same price as other forested river-bottom soils with which they are associated.

Newberg loam is a productive soil. In its present condition the application of 2 or more tons of barnyard manure to the acre would greatly increase the moisture-holding capacity. It is suitable for early-maturing fruits and vegetables. Irrigation would prove profitable.

NEWBERG SILT LOAM

To a depth ranging from 9 to 12 inches the surface soil of Newberg silt loam consists of rich-brown mellow silt loam. The upper part of the subsoil, to a depth varying from 20 to 30 inches, is rich-brown loose friable silt loam, loam, or clay loam. The deeper part of the subsoil is lighter in texture and may consist of fine sandy loam, sandy loam, or loamy sand. This layer is stratified, but it is lighter in texture than the surface soil. The sandy material has a tendency to break the capillary action of the soil, with the result that the surface soil dries out more quickly than do soils with heavier subsoils. The soil materials are slightly or medium acid. Variations in texture occur within short distances.

Several rather large tracts of Newberg silt loam occur in the Eugene area. One is one-half mile west of Coburg, others are east and southeast of Riverview School, several are near the junction of Willamette and McKenzie Rivers, several are in the vicinity of Lancaster and north of that place, a few border McKenzie River as far as Thurston, and others border Middle Fork Willamette River.

Land of this kind has a ridged or somewhat billowy relief. It is overflowed periodically. Drainage is good or excessive, except during periods of overflow. The soil dries out quickly following overflow or heavy rains and can be worked under a wide range of moisture conditions.

Newberg silt loam is a recent alluvial soil of mixed origin. About 50 per cent is forested with fir, cottonwood, willow, alder, ash, and balm. Forested areas are used as sheep and cattle pasture and the cleared areas are used in the production of nearly all crops suited to local soil and climatic conditions. Wheat and oats are the principal cash crops, and oat and vetch hay and red-clover hay are grown for feed. Dairy farmers plant an appreciable acreage to corn or kale besides the hay crops already mentioned. This soil is also used to some extent in the production of truck crops, small fruits, and tree fruits.

The yields of various crops are good when moisture conditions are favorable. Wheat yields from 20 to 40 bushels to the acre, oats from 30 to 75 bushels, and oat and vetch hay from 2 to 5 tons. Truck crops include cabbage, beets, pumpkins, squash, carrots, turnips, parsnips, potatoes, string beans, and a number of other vegetables. Melons, strawberries, raspberries, Logan and other blackberries, together with cherries and prunes, constitute the principal fruit crops. Squash yields from 10 to 12 tons to the acre, carrots from 25 to 30 tons, potatoes from 200 to 250 bushels, string beans from 2 to 4 tons, raspberries from 1 to 2 tons, and strawberries from 150 to 200 crates. Other fruits and vegetables do equally well.

Well-improved land of this kind is currently held at prices ranging from $150 to $350 an acre, and the price of unimproved land is from $40 to $80 an acre. Many of the unimproved areas are subject to erosion in time of flood.

This is a productive soil and can be maintained in a productive condition by observing good cultural practices. Crop yields could be greatly increased if irrigation were practiced. The land is suited to early fruits and vegetables as well as deep-rooted fruit and nut crops. By fencing off clover fields into small lots and turning hogs from one lot to another as they pasture down the crop very economical and profitable returns can be obtained from a small clover acreage.

Newberg silt loam, heavy phase.—The surface soil of Newberg silt loam, heavy phase, consists of brown or rich-brown friable silty clay loam from 8 to 12 inches thick. The upper subsoil layer, to a depth varying from 20 to 30 inches, consists of brown or rich-brown silty clay loam or clay loam. The lower subsoil layer is loose sandy loam, loamy sand, or other light-textured sandy material. The sandy material checks capillarity to some extent and the soil dries out more quickly than does Chehalis silty clay loam.

This soil is very inextensive, though it is mapped in a number of small widely scattered areas, several of which occur along McKenzie River near Leaburg and Hendricks. The largest area mapped is 2 miles south of Springfield. Several areas border Coast Fork Willamette River, an area occurs on Row River 1 mile northwest of Hawley, and several border Willamette River north of Eugene.

Areas of this soil are ridged or slightly furrowed and are subject to overflow, generally by quiet backwaters. Drainage is good, except during periods of overflow.

The land is largely under cultivation to the same crops as are grown on typical Newberg silt loam, but crop yields average somewhat higher. Less than 25 per cent of this land is forested with cottonwood, willow, alder, and ash.

When sold alone this heavy soil is valued at prices ranging from $150 to $350 an acre. Some of the more highly improved areas are held at slightly higher prices. Suggestions for the utilization and improvement of this soil are the same as for typical Newberg silt loam.

CAMAS GRAVELLY LOAM

The surface soil of Camas gravelly loam, to a depth varying from 9 to 14 inches, consists of brown or light reddish-brown gravelly loam. The subsoil is brown or grayish-brown gravelly sand, 60 per cent or more of which consists of cobbles and gravel. Some cobbles appear in the surface soil, though in general the gravel particles are 3 inches or less in diameter. The quantity of gravel in the surface material varies, but it is sufficient in all places to interfere with cultivation to greater or less extent. The soil is poorly supplied with organic matter.

Areas of Camas gravelly loam occur throughout the bottom lands of the Eugene area, generally in small patches. Areas occur north of Lancaster, in the vicinity of Lone Pine School, near Ferguson Bridge, 2 miles north of Pleasant Hill, 2 miles east of Goshen, along Little Fall, Fall, and Winberry Creeks, and bordering McKenzie River and Coast Fork and Middle Fork Willamette Rivers.

Camas gravelly loam occupies slight knolls in association with other soils on the river bottoms. Areas are smooth and gently sloping and are rarely overflowed. Drainage of both surface soil and subsoil is excessive.

Less than 5 per cent of the land is under cultivation, and the remainder is sparsely forested with fir, pine, and oak. Cultivated areas are used in the production of wheat, oats, and red clover hay. Wheat yields from 10 to 20 bushels to the acre, oats from 10 to 30 bushels, and clover hay from one-half to 1 ton. In seasons of drought it is common practice to cut all crops for hay.

This soil is valued as building sites because of its well-drained position, but it has a low agricultural value. When sold alone it is currently held at prices ranging from $25 to $50 an acre.

Under cultivation grain and hay crops should be fall planted. Turning under organic matter will improve the moisture-holding capacity of the soil. Land of this kind is well suited to the requirements of the poultry industry.

CAMAS GRAVELLY CLAY LOAM

To a depth ranging from 8 to 14 inches the surface soil of Camas gravelly clay loam consists of brown or rich-brown gravelly clay loam moderately well supplied with organic matter. The subsoil is brown or light reddish-brown loam or sandy loam containing 60 per cent or more of gravel and cobbles. The gravel in the surface soil are of medium size and are rounded or subangular. In some places the quantity is sufficient to seriously interfere with cultivation, and in all places the gravel are a hindrance to cultural operations. The soil materials range from medium to strongly acid.

This soil is most typically and extensively developed in the valleys of Row River and Mosby Creek. Several areas border Lost Creek. The land has a smooth gently sloping surface. It is overflowed at rare intervals. Drainage is excessive.

Under virgin conditions Camas gravelly clay loam was forested with fir, pine, oak, alder, and ash. About 50 per cent of the land is now under cultivation, principally to wheat, oats, red clover, and vetch and oats for hay. Some corn, prunes, and pears are grown. Wheat yields from 15 to 25 bushels to the acre, oats from 20 to 40 bushels, and red clover hay from 1 to 2 tons. A small acreage of this soil is under irrigation and the yields obtained are nearly double those from unirrigated areas. Prune and pear trees on this soil are in a vigorous state of growth and give fair average yields.

Improved land of this kind is currently held at prices ranging from $50 to $100 an acre, and unimproved land commands from $20 to $50.

As this soil is productive where irrigated, it would seem that larger areas could be profitably irrigated at small expense. The turning under of cover crops or barnyard manure would greatly improve the water-holding capacity of the soil. The land seems well suited to deep-rooted fruit crops.

WAPATO SILT LOAM

The surface soil of Wapato silt loam, to a depth ranging from 8 to 12 inches, consists of brown or dull-brown mellow silt loam containing a moderate amount of organic matter. The subsoil is brown or dark-brown silty clay loam or clay loam mottled with gray, rust brown, and some yellow. In some areas of this soil as mapped there is a surface deposit of organic matter from 5 to 14 inches thick. If more extensive these areas would have been differentiated as peat or muck. One small area of this kind is three-fourths mile northeast of Lorane, and another is 1½ miles east of Blachly.

Typical areas of Wapato silt loam border Triangle Lake, and occur at Vaughn, south, west, and northeast of Elmira, 2 miles southwest of Alvadore, at Cheshire and Bear Creek, 1 mile east of Sweethome School, one-fourth mile south of Fairview School, near the headwaters of Ferguson Creek, one-half mile south of Crow, and in various parts of the Eugene area in association with other recent alluvial soils.

Areas of this soil are smooth and almost flat. Water stands over the surface for short intervals during the rainy season. Drainage is poor throughout.

Under virgin conditions the land was largely grass covered, with sedges and willows occupying the more poorly drained areas. About 80 per cent of the soil is now under cultivation, principally to oats, oats and vetch, alsike clover, red clover, wheat, and corn. Potatoes are grown to some extent, and vegetables grown in home gardens produce abundantly.

Oats yield from 40 to 85 bushels to the acre, oats and vetch hay from 2 to 6 tons, alsike clover from 1 to 3 tons of hay, corn from 10 to 15 tons of silage and from 30 to 60 bushels of grain, and potatoes from 150 to 250 bushels.

Wapato silt loam is in need of drainage, which can be accomplished in most areas by deepening and straightening the existing drainage ways. The soil is productive, and it is suggested that it be utilized to a greater extent in connection with dairying. Hungarian vetch and alsike clover are the legumes to which this type of soil is best suited.

WAPATO SILTY CLAY LOAM

To a depth varying from 9 to 12 inches, the surface soil of Wapato silty clay loam consists of dull-brown or brown silty clay loam which contains an appreciable amount of organic matter. The subsoil is dull-brown or dark-brown silty clay loam or clay mottled with gray and rust brown. In places the surface soil is somewhat mottled, and in other places the mottles do not appear above a depth of 30 inches. Here and there at a depth of 24 or more inches the soil is underlain by gravel, but such areas are inextensive and could not be differentiated on the map.

The total area of this soil is large. Extensive areas are mapped in the Mohawk River Valley, along Camp Creek, near Pleasant Hill, near Cloverdale School, along Rattlesnake Creek, bordering Coyote Creek, in Lynx Hollow, at Lorane, and 1 mile south of Latham. Several tracts border Long Tom River, particularly in the northern part of the area, and many strips occur along local drainage ways northwest and northeast of Eugene.

Wapato silty clay loam has a smooth gently sloping or almost flat surface. Water stands over the surface for a few days following heavy rains. Both subdrainage and surface drainage are poorly developed.

About 60 per cent of the land is under cultivation, principally to oats, oats and vetch grown for hay, clover, corn, and wheat. Uncultivated areas are covered with grass, willows, or sedges, and are used as pasture land, generally in connection with dairying. Some potatoes and vegetables are successfully produced in home gardens.

Oats yield from 40 to 85 bushels to the acre, though some yields of 100 bushels are reported, oat and vetch hay from 2 to 5 tons, clover hay from 1 to 3 tons, corn from 10 to 12 tons of silage or from 40 to 65 bushels of grain, and wheat from 15 to 35 bushels.

Improved land of this kind is currently valued at prices ranging from $90 to $150 an acre, and unimproved land commands from $30 to $60.

This soil is in need of drainage, after which it should prove productive of a wide range of crops. In its present condition it is best suited to dairying and the production of hay and forage crops.

WAPATO CLAY

The surface soil of Wapato clay is brown or dark-brown heavy plastic clay from 8 to 11 inches thick. The subsoil consists of dark-brown clay mottled with rust brown and brownish yellow. In places the subsoil is stiff plastic clay closely approaching in character the subsoil of the Dayton soils. The surface soil in places is mottled with rust brown.

This soil is not very extensive or of particular importance agriculturally. The largest areas are in the Spencer Creek bottom and 3 miles west of Creswell. A small area lies one-half mile south of Thurston, another is 2 miles south of Central School, another 2 miles west of Cheshire, and several others border Coyote Creek, Siuslaw River, and a number of other streams in the southern and eastern parts of the area.

Areas are smooth and gently sloping or almost flat. Drainage is poorly developed throughout, and water stands over the soil for short periods during the rainy season.

Less than 40 per cent of the land is under cultivation, and the remainder, which is covered with grass, together with a few clumps of willows and sedges, is used for pasture. The cultivated areas are used in the production of oats, oat and vetch hay, alsike clover, and corn. Some wheat and cheat hay is produced with fair yields. Oats yield from 30 to 70 bushels to the acre, oat and vetch hay from 2 to 4 tons, and alsike-clover hay from 1 to 2 tons.

Improved land of this kind is held at prices ranging from $50 to $100 an acre, and unimproved land commands from $20 to $40.

Wapato clay is difficult to handle because of its heavy texture. Although wet and late during the winter season, crops suffer from lack of moisture in seasons of drought. Areas are in need of drainage. Of the leguminous hay crops alsike clover and Hungarian vetch are the best adapted to this soil.

COVE CLAY

The surface soil of Cove clay, to a depth of 8 or 10 inches, consists of very dark-gray or black clay which on drying tends to check or crumble to an adobelike structure. The subsoil consists of dark-gray or black heavy plastic clay which is largely impervious to water movement when wet, but which during the summer dries out and cracks to a depth ranging from 4 to 6 or more feet. Below a depth varying from 4 to 6 feet is dull brownish-gray friable clay loam or clay mottled with gray, yellow, and rust brown. Some rust-brown mottles occur in the subsoil. The soil is well supplied with organic matter.

Cove clay is most typically and extensively developed east and north of Coburg. Small areas are near Clear Lake School, 1½ miles east of Alvadore, 1½ miles north of Harpole School, and 2½ miles north of Creswell. The soil has a smooth gently sloping or nearly flat surface and drainage is poorly developed. Water stands over the surface for short periods during the rainy season.

A very few areas of this soil are under cultivation, in connection with other soils, and are used largely in the production of grain hay. Uncultivated areas are covered with grasses and are used as pasture land.

When sold alone the land is valued at prices ranging from $30 to $50 an acre.

It is believed that this soil could be used most advantageously by seeding it with a permanent pasture mixture and pasturing it when moisture conditions are such that the soil will not puddle. It is a productive soil but is difficult to handle because of its heavy texture.

Cove clay, foot-slope phase.—Soil of the foot-slope phase of Cove clay differs from typical Cove clay only in its position. The surface soil, to a depth of 10 or 12 inches, is dark-gray or black clay. The subsoil consists of dark-gray or black heavy plastic clay which rests on bedrock at a depth generally below 5 feet.

Soil of this phase is inextensive. Small areas are one-half mile east of Lowell on Middle Fork Willamette River, and 2 miles northeast of Goshen. The surface is smooth and moderately or steeply sloping. Surface drainage is good, but subdrainage is poor. This soil receives much seepage water from the higher slopes.

This soil is a recent deposit of mixed origin. It is largely colluvial, having been washed to its present position by run-off from the higher slopes. The foot-slope phase, as well as the typical soil, is somewhat older and has weathered to a greater extent than other recent alluvial soils of the area.

The foot-slope phase of Cove clay does not have a high agricultural value and is used entirely as pasture land. It is sold only in connection with other soils and its value is somewhat less than that of soils with which it is associated. Suggestions for the utilization and improvement of this soil are the same as those given for typical Cove clay.

ROUGH MOUNTAINOUS LAND

Bordering the valleys and foothills of the Eugene area are large undeveloped mountainous sections accessible only by means of a few poorly defined trails. Here the soils occupy rough mountainous areas so steep and broken that they are largely unfit for agriculture. It is recognized, however, that with further development of the region, small, scattered areas will be found to be of sufficiently favorable relief and soil condition to allow profitable agricultural development. In this survey it was not considered advisable to spend the time necessary to map these areas in detail, and, following the procedure in previous surveys, they have been grouped and classified as rough mountainous land.

The soils are mainly derived from weathered consolidated rocks and include a number of undifferentiated soils. In the western part of the area the soils are largely derived from shale or sandstone and belong to the Sites or Melbourne series, depending on the degree of oxidization and the color of the surface soils. In the southern and eastern parts of the area the soils grouped in this classification are derived largely from basalt or tuffaceous conglomerate and if mapped in detail would be placed in the Olympic and Aiken series. The soils vary in thickness from a few inches to 5 or more feet and in many places the underlying bedrock crops out over small areas. Stones and bowlders are abundant over the surface and embedded in the soil material.

A few small areas of rough mountainous land have been logged and are now in stumps. The remainder is heavily forested with fir, spruce, and cedar. Ferns and underbrush make these areas almost inaccessible except by trails. The soils are valued largely for their timber growth, though some areas are used for sheep, goat, or cattle pasture. However, most of these areas under prevailing conditions are best suited to forestry.

ROUGH BROKEN AND STONY LAND

Associated with the agricultural lands of the area, both on the valley floors and in the foothills, are buttes or outcrops of the underlying bedrock that are so rough, broken, or stony as to render them entirely unfit for agriculture. Such areas have been mapped as rough broken and stony land regardless of their origin or other characteristics.

Several areas of this kind are northeast of Coburg, 2 miles east of Goshen, at Spencer Butte, at Cox Butte, and bordering the valley lands at various places.

This land has no agricultural value other than for the light pasturage it affords. A part of the land supports a timber growth only.

RIVER WASH

River wash is a nonagricultural class of material consisting of unassorted sands, gravel, and cobbles. It lies only a few feet above the normal flow of the river, ordinarily in open channels or as bars or low terraces along the banks. This soil material is extensively developed along McKenzie River, Willamette River, and Coast and Middle Forks Willamette River. In general river wash supports no form of vegetation, but in a few protected areas willows have established a foothold. This land is overflowed annually, part of it remaining under water for several months of the year.

SUMMARY

The Eugene area is in the central part of Lane County, in the west-central part of Oregon. The area embraces 1,298 square miles, or 830,720 acres. It includes the valley and terrace lands bordering Willamette River and its tributaries and the contiguous mountainous areas which comprise parts of the Cascade and Coast Ranges. Most of the agricultural land in the county is included in this survey.

Elevations within the area range from 320 feet at Junction City to more than 4,000 feet in the mountainous section.

The land is well drained except in several large flat areas which occupy parts of the main valley floor.

The early settlers occupied the treeless terraces above the river flood plains, but settlement was soon extended to cover all the open prairie land of the area. Lane County was organized in January, 1851, and named in honor of the Territorial governor, Gen. Joseph Lane.

The early population was drawn chiefly from the Eastern and Central States. Ninety per cent of the population is American born. The population of the county in 1920 was 36,166. The river valleys are the most thickly populated sections and the large mountainous areas are uninhabited. Eugene is the county seat and largest town of the area.

The area is unusually well supplied with transportation facilities, furnished mainly by the Southern Pacific Railroad system. For a few months each year Willamette River is navigable for light-draft river vessels as far south as Eugene. The Pacific Highway (paved) gives easy access to the principal cities of the State and neighboring States. A number of well-improved macadam roads connect with other important highways of the State. The county roads are in good condition.

Telephones are in general use, and electricity is available in all the larger towns. Local markets absorb much of the fresh fruit and vegetables. Surplus agricultural products find a market in Portland or are shipped to outside markets.

The climate in the Eugene area is mild, without sudden or severe changes in temperature from day to day or from season to season. In the adjacent mountainous areas the climate is more severe, some of the higher elevations being snowcapped throughout the year. Snowfalls in the valley are light and of short duration. The climate

is favorable to the production of winter grains. The average length of the frost-free season at Eugene is 197 days. The pasturing of livestock is limited by the wet condition of the fields rather than by severe weather.

Agriculture has been the dominant industry since the first settlement in 1848. The early agriculture consisted of the grazing of animals on the grass-covered prairies and the production of enough cereals, vegetables, and fruit to supply home or community needs. By 1860 the majority of the valley lands had been taken up.

Dairying first came into prominence about 1900. With it the acreage in corn, clover, alfalfa, and vetch increased. With the growing of more legumes and the beginning of the practice of crop rotation the agriculture of the area was placed on a more permanent basis.

At the present time agriculture consists of the production of general farm crops, dairying, poultry raising, truck gardening, and fruit and nut production. Wheat and oats are the principal cash crops, and oats and vetch, clover and corn are grown on nearly every farm for livestock feed or seed. Wheat and red clover are grown largely on the better-drained upland soils. Alsike clover, oats, and vetch are grown on the well-drained soils as well as those with poor drainage. A 3-year rotation of oats, wheat, and clover is in general favor.

Farm buildings are of good construction, though many are in need of repair. Work animals are of medium weight. Light tractors are in common use.

Commercial fertilizers are little used by farmers in this area. Farm laborers are largely American born and efficient. The labor supply is plentiful.

Improved well-drained upland soils are currently held at prices ranging from $100 to $150 an acre, and hill land and poorly drained land commands from $25 to $75.

As the Eugene area is situated in the Pacific coast soil region in middle western Oregon, the soils have developed under the influence of moderately high winter rainfall and a comparatively low summer rainfall. Extreme winter or summer temperatures are rare.

The soils of the area fall into four groups—soils from residual materials, soils from old alluvial deposits, recent alluvial soils, and miscellaneous materials. The last group includes rough mountainous land, consisting of elevated mountain areas not covered in detail but in which small scattered areas of agricultural land may be found with later development; rough broken and stony land; and river wash which is entirely nonagricultural.

The residual soils are derived from the weathering in place of basalt, tuffaceous conglomerate, sandstone, and shale. Basalt and tuffaceous conglomerate have given rise to soils of the Aiken, Polk, Olympic, and Viola series. Sandstones and shales have given rise to soils of the Sites, Melbourne, and Carlton series.

The old valley-filling soils are derived from weathered unconsolidated alluvial deposits. They are classified in the Salkum, Veneta, Willamette, Amity, Dayton, Holcomb, Salem, Clackamas, and Concord series.

The recent alluvial soils are still in the process of accumulation. They are grouped in the Chehalis, Newberg, Camas, Wapato, and Cove series.

The residual soils are used largely in the production of wheat, oats, vetch, and clover. Some prunes and walnuts are grown on them. Moisture is the limiting factor in crop production on these soils. The well-drained soils from old alluvial deposits are used in the production of wheat, oats, red clover, vetch, corn, potatoes, vegetables, and fruits. The poorly drained old valley-filling soils are used in the production of oats, vetch, cheat hay, and corn on some of the better-drained areas. The recent alluvial soils are used in the production of a wide range of crops suited to local climatic conditions.

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[PUBLIC RESOLUTION—NO. 9]

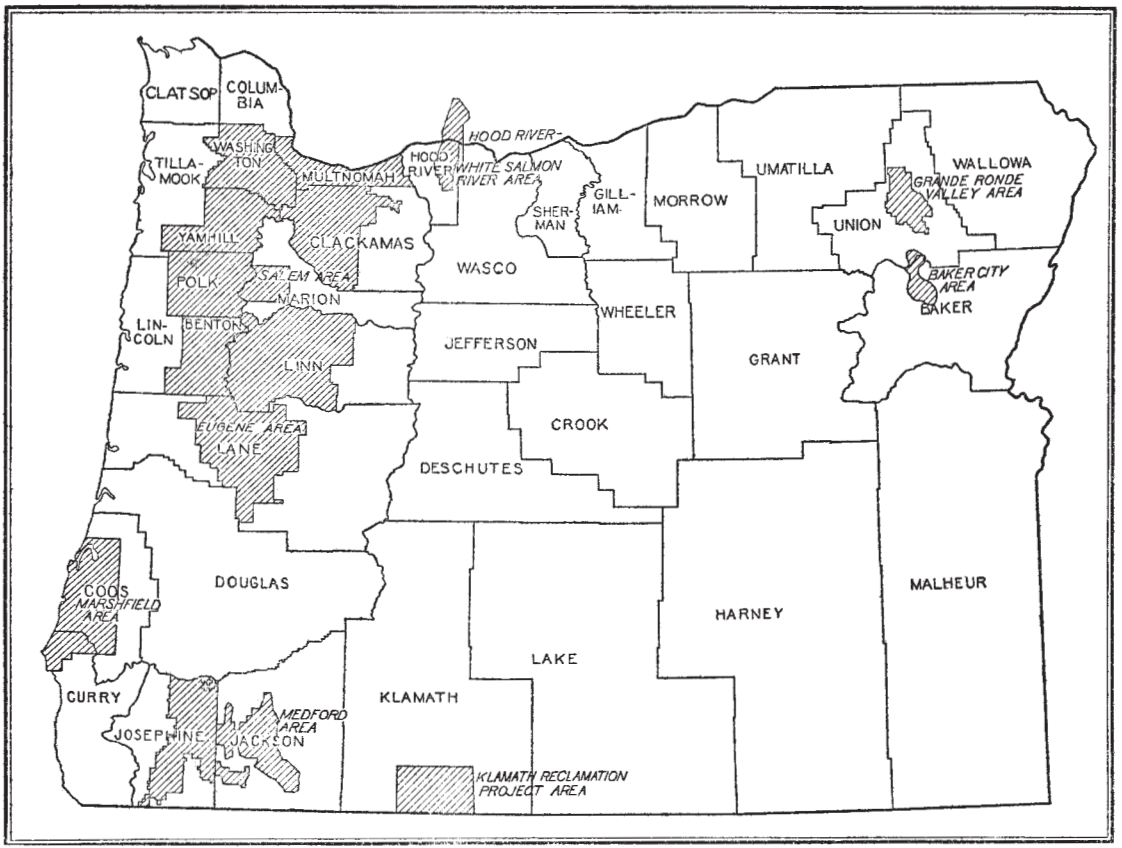
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils, and on July 1, 1927, the Bureau of Soils became a unit of the Bureau of Chemistry and Soils.]



Areas surveyed in Oregon, shown by shading

U. S. GOVERNMENT PRINTING OFFICE: 1930

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(2) fax: (202) 690-7442; or

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U. S. DEPARTMENT OF AGRICULTURE
BUREAU OF CHEMISTRY AND SOILS
HENRY G. KNIGHT, CHIEF
A. G. McCALL, CHIEF, SOIL INVESTIGATIONS
CURTIS F. MARBUT, IN CHARGE SOIL SURVEY

SOIL MAP
EUGENE AREA–EASTERN SHEET
OREGON

OREGON AGRICULTURAL EXPERIMENT STATION
J. T. JARDINE, DIRECTOR
W. L. POWERS, CHIEF IN SOILS


R.3 W.
R.2 W.
R.1 W.
R.1 E.
R.2 E.
T.15 S.
T.16 S.
T.17 S.
T.18 S.
T.19 S.
T.20 S.
T.21 S.
CASCADE
NATIONAL FOREST
UMPQUA
NATIONAL FOREST
CONVENTIONAL SIGNS
LEGEND
Aiken silty clay loam
Al
Chehalis loam
Cl
Dayton silty clay loam
Ds
Newberg silt loam
Ns
Salkum clay loam
Sc
Wapato silty clay loam
Wc
Amity silt loam
Am
Chehalis silt loam
Co
Ds
Dark-colored phase
Ns
Heavy phase
Sc
Compact-subsoil phase
Wapato clay
Wa
Amity silty clay loam
Ac
Chehalis silty clay loam
Cm
Dayton clay, Dark-colored phase
Dc
Olympic clay loam
Ol
Sites clay loam
Sl
Willamette loam
W
Ac
Light-brown phase
Cm
Gravelly phase
Holcomb clay loam
H
Ol
Stony phase
Veneta loam, Compact-subsoil phase
Vl
Willamette silty clay loam
Wm
Camas gravelly loam
Ca
Clackamas gravelly loam
Cg
Melbourne clay loam
Mc
Polk silty clay loam
Ps
Veneta clay loam
Ve
Wm
Gravelly phase
Camas gravelly clay loam
Cr
Clackamas gravelly clay loam
Ck
Newberg loamy sand
Nd
Salem gravelly clay loam
Sg
Viola silty clay loam
Vc
River wash
Rv
Carlton silty clay loam
Cs
Cove clay
Cc
Newburg fine sandy loam
N
Sg
Light textured phase
Wapato silt loam
Wo
Chehalis fine sandy loam
Cf
Cc
Foot slope phase
Newberg loam
Nl
Rough mountainous land
R
Rough broken and stony land
Rb
DIAGRAM
Showing surveyed and unsurveyed portions of Lane County
SURVEYED

Macy H. Lapham, Inspector, District 5.
Soils surveyed by E. J. Carpenter, in charge, and T. W. Glassey,
U. S. Department of Agriculture, and A. O. Alben and V. D. Young,
Oregon Agricultural Experiment Station.

Scale $\frac{1}{62,500}$
1 ½ 0 1 2 3 4 Miles

WILLIAMS & HEINTZ CO. WASH. D.C.

Field Operations
Bureau of Soils
1925

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BASE MAP IN PART FROM U. S. GEOLOGICAL SURVEY SHEETS

Scale $\frac{1}{62500}$

1 ½ 0 1 2 3 4 Miles

1 ½ 0 1 2 3 4 5 Kilometers

Contour interval 5 10 and 25 feet.
Datum is mean sea level.

WILLIAMS & HEINTZ CO. WASH. D.C.

Field Operations
Bureau of Soils
1925